LENOVO T5i TESTED PG.80

RTX 4060 REVIEWED PG.74

BEST WIRELESS **HEADSETS** PG.12

MAXIMUMPC

MINIMUM BS • SEPTEMBER 2023 • www.maximumpc.com

RTX FOR UNDER $940

- Latest tech at a bargain price
- Intel 13th Gen and Nvidia 40-series

BUILT & BENCHED IN-DEPTH GUIDE PG.16

BRING OLD PCs BACK TO LIFE! PG.52

SPEED UP FOR FREE PG.32

FUTURE
VOL 28, NO 9

DIGITALSTORM

PC GAMER
EDITOR'S CHOICE
MAXIMUM PC
KICK ASS!

We build the world's most advanced PCs.

Experience a new level of performance with an award-winning Digital Storm PC. Built with the latest technology, highest quality components and backed by lifetime support. Visit our website and build your dream PC today.

DIGITALSTORM

LEARN MORE: WWW.DIGITALSTORM.COM
Digital Storm PCs featuring Intel® Core™ i7 processors.

intel CORE i7 inside

The Digital Storm Logo, and 'World's Most Advanced PCs' are trademarks of Digital Storm.Intel, the Intel Logo, Intel Inside, Intel Core, and Core Inside are trademarks of Intel Corporation in the U.S. and/or other countries.

gamesradar+

One-stop destination for games, movies, TV, and more!

New Channels: Movies, TV and Cool Stuff!

www.gamesradar.com

inside

SEPTEMBER 2023

SCAN TO GET THE
TOM'S HARDWARE
WEEKLY NEWSLETTER

QUICKSTART

8 **THE NEWS**
ASUS takes over Intel's NUC; Modular laptop goes 16-inch; Laptops to get Ryzen V-cache.

12 **THE LIST**
The Best wireless headsets for gaming.

Excellent audio without the anchor of a cable tying you to your desktop.

40 **SUBSCRIBE TODAY**
Subscribe to *Maximum PC* and receive a digital copy of these guides, and 100+ back issues.

50 **CENTERFOLD**
We look into the Skytech Chronos 2.

R&D

61 **HOW TO**
Spruce up the Taskbar; Build a database with Data Crow; Convert videos with presets.

LETTERS

14 **DOCTOR**

94 **COMMENTS**

16 **RTX FOR UNDER $900**

32 **SERVICE AND TUNE YOUR PC**
Nick Peers on how to keep your desktop device in fighting-fit condition.

42 **SWITCH TO DUCKDUCKGO**
Why the private search engine is the best Google Chrome alternative around.

52 **SAVE YOUR OLD PC**
How to avoid replacing your existing gear by working with what you already have.

© GEARBOX PUBLISHING, RAZER

IN THE LAB

74 **MSI RTX 4060 VENTUS BLACK 2X OC**

76 **CORSAIR XENEON 27QHD240**

80 **LENOVO LEGION TOWER 5I**

90 **REMNANT 2**

UNEARTH THE FULL STORY BEHIND THE LEGEND OF ZELDA

Explore every game in the series and what makes each one so great. If you're a fan, you'll enjoy the trip through time. If you're a newcomer, we offer you this sage advice: "It's dangerous to go alone, take this!"

OLD!
retro GAMER PRESENTS
100% UNOFFICIAL
THE STORY OF ZELDA
DISCOVER THE COMPLETE HISTORY OF HYRU
BRAND NEW
TEARS OF THE KINGDOM REVEALED
EVERY GAME IN THE SERIES EXPLORED
BEHIND-THE-SCENES ACCESS
TIMELINES EXPLAINED
Digital Edition

ON SALE NOW

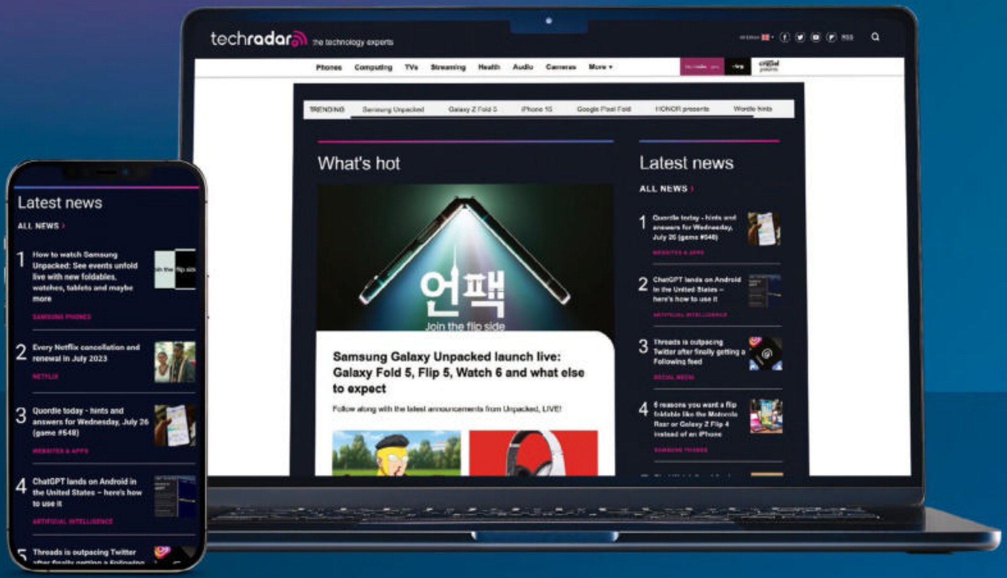
FUTURE

Shop easily online at:

magazinesdirect.com

bit.ly/3xbOGXq

Meet the technology experts



techradar the technology experts
Phones
Computing
TVs
Streaming
Health
Audio
Cameras
More
TRENDING
Samsung Unpacked
Galaxy Z Fold 5
iPhone 15
Google Pixel Fold
HONOR presents
Wordle hints
언팩
Join the flip side

What's hot

Samsung Galaxy Unpacked launch live: Galaxy Fold 5, Flip 5, Watch 6 and what else to expect

Follow along with the latest announcements from Unpacked, LIVE!

Latest news

ALL NEWS ›

1 Quordle today - hints and answers for Wednesday, July 26 (game #548)
WEBSITES & APPS

2 ChatGPT lands on Android in the United States – here's how to use it
ARTIFICIAL INTELLIGENCE

3 Threads is outpacing Twitter after finally getting a Following feed
SOCIAL MEDIA

4 5 reasons you want a flip foldable like the Motorola Razr or Galaxy Z Flip 4 instead of an iPhone
SAMSUNG PHONES

Latest news

ALL NEWS ›

1 How to watch Samsung Unpacked: See events unfold live with new foldables, watches, tablets and maybe more
SAMSUNG PHONES

2 Every Netflix cancellation and renewal in July 2023
NETFLIX

3 Quordle today - hints and answers for Wednesday, July 26 (game #548)
WEBSITES & APPS

4 ChatGPT lands on Android in the United States – here's how to use it
ARTIFICIAL INTELLIGENCE

5 Threads is outpacing Twitter

- The world's **most** comprehensive technology website
- An **unrivalled** mix of news, opinions, reviews and features
- **All-new design**, new homepage, new features and special reports
- Backed by **over 300 years** of editorial experience

techradar
the technology experts

www.techradar.com

MAXIMUMPC

EDITORIAL
Editor-in-Chief: Guy Cocker
Staff Writer: Sam Lewis
Contributing Writers: Tabitha Baker, Jonni Bidwell, Reece Bithrey, Ian Evenden, Robert Irvine, Jeremy Laird, Rick Lane, Chris Lloyd, Nick Peers, Michelle Ray Uy, Jacob Ridley, Chris Szewczyk, Jarred Walton, Katie Wickens
Production Editor: Steve Wright
Editor Emeritus: Andrew Sanchez

ART
Art Editor: Fraser McDermott
Photography: Neil Godwin, Olly Curtis, Phil Barker
Cover Photo Credits: Andeze, Getty Images, Future PLC

BUSINESS
US Marketing & Strategic Partnerships: Stacy Gaines, stacy.gaines@futurenet.com
US Chief Revenue Officer: Mike Peralta, mike.peralta@futurenet.com
East Coast Account Director: Brandie Rushing, brandie.rushing@futurenet.com
East Coast Account Director: Michael Plump, michael.plump@futurenet.com
East Coast Account Director: Victoria Sanders, victoria.sanders@futurenet.com
East Coast Account Director: Melissa Planty, melissa.planty@futurenet.com
East Coast Account Director: Elizabeth Fleischman, elizabeth.fleischman@futurenet.com
West Coast Account Director: Austin Park, austin.park@futurenet.com
West Coast Account Director: Jack McAuliffe, jack.mcauliffe@futurenet.com
Director, Client Services: Tracy Lam, tracy.lam@futurenet.com

MANAGEMENT
CEO: Jon Steinberg
MD Tech: Paul Newman
Group Editor-in-Chief: Graham Barlow
Group Art Director: Warren Brown

PRODUCTION
Head of Production: Mark Constance
Senior Production Manager: Matthew Eglinton
Production Manager: Vivienne Calvert
Production Assistant: Emily Wood

Future US LLC, 130 West 42nd Street,
7th Floor, New York. NY 10036. USA. www.futureus.com

INTERNATIONAL LICENSING & SYNDICATION
Maximum PC is available for licensing and syndication.
To find out more, contact us at licensing@futurenet.com or view our available content at www.futurecontenthub.com.
Head of Print Licensing: Rachel Shaw, licensing@futurenet.com

SUBSCRIBER CUSTOMER SERVICE
Website: www.magazinesdirect.com
Tel: 844-779-2822
New Orders: help@magazinesdirect.com
Customer Service: help@mymagazine.co.uk

BACK ISSUES
Website: https://bit.ly/mpcsingleissue

Next Issue On Sale September 12th, 2023

EXTRA DIGITAL FEATURES
AUDIO FILE
PHOTO GALLERY
VIDEO FILE

© 2023 Future US, Inc. All rights reserved. No part of this magazine may be used or reproduced without the written permission of Future US, Inc. (owner). All information provided is, as far as Future (owner) is aware, based on information correct at the time of press. Readers are advised to contact manufacturers and retailers directly with regard to products/services referred to in this magazine. We welcome reader submissions, but cannot promise that they will be published or returned to you. By submitting materials to us, you agree to give Future the royalty-free, perpetual, non-exclusive right to publish and reuse your submission in any form, in any and all media, and to use your name and other information in connection with the submission.

FUTURE
Connectors.
Creators.
Experience
Makers.

Future plc is a public company quoted on the London Stock Exchange (symbol: FUTR)
www.futureplc.com

Chief Executive Officer **Jon Steinberg**
Non-Executive Chairman **Richard Huntingford**
Chief Financial and Strategy Officer **Penny Ladkin-Brand**

Tel +44 (0)1225 442 244

© GETTY IMAGES

Guy
Cocker

RTX FOR LESS

IT'S TAKEN A WHILE, but this month we've finally been able to build a current-gen RTX gaming PC for under $1,000! We've done quite a few value-oriented gaming builds over the last year, but we've had to use Intel's Arc card (May 2023 issue) or the ageing RTX 3050 (November and December 2022) to hit a three-figure price point. While we might often bemoan Nvidia in these pages, we're very aware that they still dominate the graphics card market with an 84 percent market share, so it's the manufacturer most PC gamers care about. For the first time ever, we've been able to spec up and build a machine with a cutting-edge 40-series Nvidia graphics card at under a grand.

The RTX 4060 itself may not have fared as well as its 4060 Ti bigger brother in our review (which you can read on page 74)—our verdict is that it should have been called an RTX 3050. It's the same feeling we've had about a lot of Nvidia's 2023 releases—the silicon you're paying for doesn't really justify the category (or price) it's advertised at. That sucks, and we as consumers should be complaining about it. But in the Lovelace generation, that doesn't tell the whole story, as technology such as DLSS3 and Frame Generation mean that as long as you're okay with using these AI-powered image-enhancement techniques, you can increase frame counts and/or resolution beyond what you can without them. This is what Sam was most impressed with when he spoke to me for our Story of the Build video feature (page 16)—that he was able to play games like *Cyberpunk 2077* with ray tracing at 1440p at above 60 frames per second. Compared to buying a PlayStation 5 for half the price, that sounds pretty good to me. You can find the full build from page 16 onwards.

The theme of good-value gaming PCs runs through a lot of this issue, in fact. The Skytech Chronos 2, which stars in this month's Centerfold, and the Lenovo Legion Tower 5i, which is in our reviews section, both pack a punch at $1,500 and $1,700 respectively. In fact, the pre-built Legion has a similar Intel Core i7 13700/RTX 4070 combo we used in our July 2023 cover build, but at over $600 less! Well done, Lenovo!

As well as budget graphics cards, we have a smorgasbord of other PC tech in our reviews section this month, boasting some high scores to boot. Jeremy Laird looks at another new OLED monitor contender, Corsair's Xeneon 27QHD240, to see if Alienware's ultrawides finally have some competition. Acer's Predator Helios 16 is an exciting RTX 4080 laptop that comes in at a highly reasonable price without any huge compromises. I've not even mentioned our brilliant features yet, but if you're sick of Windows running sluggishly and you haven't quite got it in you to do a reinstall, check out our resident Doctor Nick Peers' guide to servicing and tuning up your PC to give it the boost it needs.

If your PC is a little older, look at our guide to repurposing it as a Linux machine, to give to someone in education, use it as a server, or just to learn some command line tricks. My personal to-do is to finally ditch Google Chrome and move to the more private and secure DuckDuckGo, following our huge guide to the increasingly popular web browser this month.

Enjoy the issue!

Guy Cocker

Guy is Maximum PC's Editor-in-Chief. He built his first gaming PC in 1997 to play Tomb Raider *on 3dfx, and has been obsessed with all things PC ever since.*

↘ submit your questions to: editor@maximumpc.com

THE NEWS

Chat Wars

Big tech is betting big on chatbots, but cracks and concerns are starting to appear

CHATBOTS seemed to go from amusing experiment to Next Big Thing in a matter of weeks. The big boys piled in, and a race began. Nobody wanted to be left out. The major players are now all in place, as Apple has decided to join in. It's to develop its own system called, unimaginatively, AppleGPT. According to Apple's CEO Tim Cook, the company will use AI in a "thoughtful" way.

Building these large language models requires oodles of data, and the obvious source for that is the internet. Swiping data from the internet without asking is an annoyance for Apple, a company that takes privacy a little more seriously than the rest. Google has just quietly updated its terms and conditions to make it clear that all publicly available data will be used to train its AI systems. This includes social media, blogs, news, comments, reviews, website profiles, cookies, and other web activity. Basically, everything.

Worried? Well, the internet has been scraped many times before, and unless there's a radical shift, it will continue to be a source of data. There are issues about ownership and copyright that occasionally question the process, and OpenAI is getting repeatedly sued. A lawsuit was launched in California claiming that the company had scraped vast amounts of personal data, including social media pages, private conversations, financial, and even medical data. The lawyers claimed OpenAI had decided to "pursue profit at the expense of privacy, security, and ethics".

One source of data was the use of ChatGPT by medical practices who failed to realize that anything typed into ChatGPT is fed into the data machine, including the list of your symptoms. Another source was photographs of children, used to train DALL-E. Other plaintiffs include authors who discovered that their copyrighted material can be accurately summarized by ChatGPT. There will be a lot more of this as people begin to truly appreciate that if you put something online, you no longer control or own it.

ChatGPT, for all its cleverness, is inconsistent, and it's getting worse, or so say a group of researchers at Stanford and UC Berkeley. They decided to see it they could measure a decline in accuracy, set ChatGPT a series of tasks, and found that results varied considerably over time. In a math question, it ran from 2.4 to 97.6 percent accuracy. ChatGPT is in constant flux, with no basic quality checks. Yet, people use it for potentially important applications that will affect people's lives.

> OpenAI has made calls for better regulation of the AI industry

Other research has shown that the AI image generators' systems go 'mad' after being trained on AI-generated content five times—mad here meaning Model Autophagy Disorder, where data eats itself, and images become distorted. This is a concern, as AI content proliferates on the internet, only to be scraped off and fed back to the same AI.

One issue is the lack of rules, procedures, safeguards, and standards. Enter the Federal Trade Commission, which has opened an investigation into whether ChatGPT's propensity to serve misleading information poses a risk to people's reputations, and sent a letter to Microsoft asking how they assess these risks. That's not going to be easy to answer; AI doesn't work like that. The FTC has a point though, and there is support in Congress for regulation.

OpenAI is not adverse to regulation either. The company's CEO, Sam Altman, made an appearance before a US Senate committee, pushing for regulations. "I think if this technology goes wrong, it can go quite wrong." One area of concern he highlights is the targeting of misinformation designed to influence elections. Geoffery Hinton, sometimes known as the godfather of AI, quit Google earlier this year. He claims to now regret some of his work, dubbing chatbots "quite scary". He warns that bad actors will use AI for bad things. All technology suffers from this, but AI offers an awful lot of scope for 'bad things'.

One such bad actor is WormGPT. This is an AI system with no ethical boundaries or limitations, or so its creators claim. It was trained specifically to create malware tools, writing code, and suggesting tactics. It is also good at writing emails designed to elicit a financial response. The growth of such a transformational technology is bound to throw up issues. Some are mere annoyances (Amazon's self-published books mostly turning into drivel), and others more serious (job losses, population manipulation, etc). Basic questions over accuracy, malicious use, privacy, and legal standing remain unanswered. The genie is out of the bottle, we have to learn to live with it.**–CL**

© CHATGPT

ASUS TAKES OVER INTEL'S NUC

INTEL HAS PULLED OUT of the NUC business. The company has decided to stop all direct investment, but will continue to work with partners on NUC projects. Intel has been making these boxes since 2013. They started small, but over the years some have grown fatter with the need to incorporate bigger components, diluting the format. They also slowly became less competitive and innovative as other makers joined in. The move away from PC production is part of the company's restructuring under Pat Gelsinger. Enter ASUS, which has a non-exclusive license to continue NUC production. It already has plans for a ROG version to replace the NUC Extreme. It's expected to launch with 14th generation Raptor Lake silicon coupled to a high-end GeForce RTX. Other makers are expected to join the NUC market too, meaning the format will live on. **–CL**

LAPTOPS TO GET RYZEN V-CACHE

A new AMD processor is on the way

AMD'S V-CACHE TRICK, sticking a wedge of L3 cache onto its chiplets, turns a good Ryzen processor into a gaming monster. AMD has a new version coming, the Ryzen 9 7945HX3D, this time aimed at laptops via a member of its Dragon Range of high-end mobile processors. It's a 16-core, 32-thread Zen 4 flagship chip with a maximum boost of 5.4Ghz. Dragon Range chips are selectively binned and have a voltage frequency curve tuned for lower voltages, meaning less heat for the same speed. ROG is reportedly preparing a version of the Strix Scar 17, which is to be armed with the new chip. AMD has not confirmed the new X3D Ryzens, but there are three leaked listings showing the chip is on the way. If this pans out, it'll make for fast, expensive, and desirable gaming laptops. Rumor also has it that there will be 12-core, and 8-core V-Cache chips to follow. **–CL**

THOSE WHO DARE
FOR THOSE WHO DARE
FOR THOSE WHO DARE

Tech Triumphs and Tragedies

A monthly snapshot of what's good and bad in tech

TRIUMPHS

✓ **RETRO GAMING**
Microsoft has added Antstream Arcade cloud gaming to the Xbox.

✓ **FEEL THOSE KILLS**
Ubisoft has sponsored a special edition of OWO's haptic gaming shirt, offering 30 physical sensations.

✓ **REMOVABLE BATTERIES**
We could return to phones with easily replaceable batteries, as proposed EU regulation calls for devices to offer this by 2027.

TRAGEDIES

✗ **ARIZONA FAB DELAY**
TSMC's new fab has been unable to train enough skilled staff, which is expected to delay production of wafers until 2025.

✗ **FAILURE TO LAUNCH**
Project Iris, Google's AR glasses offering real-time translation, has been canned.

✗ **PLANNED OBSOLESCENCE**
Chromebooks have a death date of as little as three years, so many are dumped. Google promises eight years of life.

© INTEL, NVIDIA, ASUS

GEFORCE RTX 4060 TI 16GB SNEAKS OUT

Same card, more VRAM

A NEW GEFORCE—time for trumpets, or perhaps not. This launch was a rather muted affair from Nvidia, who slipped out a 16GB version of its GeForce RTX 4060 Ti. It didn't send out the usual round of samples for review, and there was no Founders Editions either. Nvidia's partners were also quiet, and some haven't even announced versions yet. This is the same card as the 8GB version, but with extra memory. Nvidia did give out some bar charts to show performance. Oddly, these were all at 1080p, when 16GB should give enough headroom to go for 1440p. The previous generation of cards at this level were certainly marketed for 1440p gaming. Nvidia's figures show the 16GB card giving, for the most part, the same performance as the 8GB version.

Top-tier games increasingly need 16GB to run with all the options ticked, and many were disappointed when the 4060 Ti arrived with 'only' 8GB. Well, that extra memory is here, and it costs $100 more at $499. It was naturally pitched against the 8GB version at both 1080p and 1440p. It was better, of course—smoother, and with higher frame rates. However, many big titles are happy with 8GB, and here the card turns in a nearly identical performance. As games increasingly move to 16GB, it'll be more useful, but currently its usefulness relies on a select group of games that can use the extra room, albeit on a 128-bit bus. The balance is off here, between bus width, memory capacity, and GPU, that just doesn't seem to work. We await more conclusive review to see what's going on, but first impressions are that it gets dominated by a 12GB RTX 4070, and struggles to best its smaller sibling, let alone its Radeon rivals. **–CL**

The same card—twice the VRAM, but on the same bus. The 16GB RTX 4060 Ti is expensive, and delivers patchy performance.

DIRECTSTORAGE FINALLY IN A PC

Ratchet & Clank first to use GPU decompression

MICROSOFT RELEASED the DirectStorage 1.2 SDK last April, and it has finally reached PC. *Ratchet & Clank: Rift Apart* from Insomniac Games will be the first PC game to make use of it—specifically GPU decompression to boost loading times and offer real-time asset loading.

The title was originally on PlayStation 5, and requires a beefy system to play with all the options ticked. If you play at 1080p or better, then it asks for 75GB of SSD space. The game features jumping between dimensions, which involve loading lots of graphical elements quickly. This is usually handled by the CPU, which is already busy shifting data. Using DirectStorage, this job can be passed over to the GPU, which can shift assets from storage to GPU, and decompress them in the background. It can manage multiple gigabytes of small files in a second. This removes the need for a loading screen to interrupt play, allowing seamless transitions from different environments.

This PC version has a slew of tech to enhance things, including DLSS2/3, DLAA, AMD FSR 2, and Intel XeSS. There are also ultrawide aspect ratios, tweaked raytracing, and shadows. It was an ideal game to show what DirectStorage can do, since it was developed to make use of the PS5's high-speed SSDs, and makes quick transitions between worlds a gameplay feature. Expect to see more DirectStorage-enabled games in the future. The game is available on Steam and Epic Games Store now.

They said it couldn't be done, but DirectStorage means the PC version of *Racheet & Clank* can pull its party trick of smooth game world transitions.

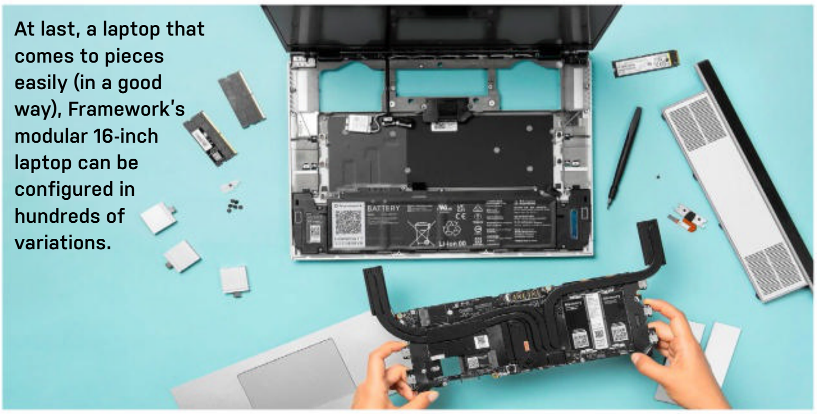
© SONY INTERACTIVE ENTERTAINMENT

Modular laptop goes 16-inch

LAPTOPS AREN'T FLEXIBLE THINGS, and can be difficult to repair or update. After a few years, it's generally time to start over again. Framework's Laptop 16 can be dissembled without specialist tools, and parts easily replaced or upgraded. The company is a proponent of the Right to Repair movement. It launched its 13-inch version in 2021, and scored 10 out of 10 on iFixit. Now, it has a 16-inch version that can be configured as a gaming system, all using the same modular construction.

Prices start at $1,399 if you fancy putting it together—$1,699 for one ready assembled. However, once you delve into the options, those prices creep up. The base processor is a Ryzen 7 7840HS, or a Radeon RX 7700S graphic module if you fancy a $2,099+ gaming rig. Memory ranges from 8GB to 64GB. Storage runs from 250GB to 4TB of primary, and 1TB or 2TB of secondary. There's a plethora other options, including colors, keyboards, and LED lights. There are six expansion bays, and you'll need a USB-C card for recharging. Other options include a headphone jack, HDMI, Ethernet, MicroSD, and DisplayPort. Every part is made to clip or screw into place.

However, there's a premium to pay. You could buy a comparable gaming system for around two thirds the cost. If you're chasing performance, you'll probably change that every two or three years. Will replacing multiple parts be competitive in the long-run? Opinion is divided. Consumer electronics have a poor reputation for sustainability. Framework's approach is refreshing among a sea of kit that gets binned due to the simplest of faults. The next batch of systems are due to be shipped early next year. **–CL**



At last, a laptop that comes to pieces easily (in a good way), Framework's modular 16-inch laptop can be configured in hundreds of variations.

Radeon RX 7800 & 7700 this fall

AMD's new Radeon release schedule has been lethargic. We got the high-end RX 7900 XTX and 7900 XT last December, then had to wait six months for the mid-range RX 7600. Meanwhile, Nvidia filled out its range of new Ada Lovelace cards, bar the budget models. Rumor has it that AMD is ready to fill that gap with the RX 7800 and 7700. Cards are on sale in September. Both cards carry Navi 32 GPUs. The 7800 will have 60 Compute Units and 16GB of memory. The 7700 will have 54, or 48 CUs, and 12GB of room to play. Why the delay? The whisper is that AMD wanted to sell its stock of Navi 21 cards first. **–CL**

GDDR7 due next year

Samsung has finished development of the world's first GDDR7 DRAM chips. They claim a one third increase over the best GDDR6 can offer, with a peak of 32Gbps per pin. There's potential for further development, as GDDR6 launched at 14Gbps, and Samsung promised 36Gbps for GDDR7. The magic is achieved by PAM3 (Pulse Amplitude Modulation), rather than NRZ (Non Return to Zero). The new chips are claimed to be 20 percent more energy efficient, and a new epoxy compound reduces thermal resistance by 70 percent. Micron isn't far behind, and is also planning to release chips next year. It still hopes to hit 36Gbps per pin at launch. **–CL**

Jarred Walton

TECH TALK

Nvidia RTX 4060 Ti 16GB Launches

WITH ALL THE FANFARE of a beginning band student, Nvidia 'launched' the RTX 4060 Ti 16GB on July 18. Except, much like with a few other less desirable GPUs in previous years, Nvidia opted not to sample media and press with review hardware.

MSI's white RTX 4060 Ti Gaming X Slim launched in July, but reviews were elusive.

© NVIDIA

Even worse, while listings showed up as planned, everything showed "auto-notify" or "back ordered" for at least the next week. Cards are finally starting to be available, but reviews are few and far between. You might think it's no big deal, but Nvidia's RTX 40-series graphics cards have received a lot of negative press over the past few months. The consensus tends to be that while the RTX 4090 is an excellent halo product, everything else has been cut back too far, with prices that are out of touch with the current market conditions. It's almost like all the planning and design of Ada Lovelace happened during a time when you couldn't find any graphics card in stock at a reasonable price. As we've noted, the various product tiers do generally outperform their predecessors, so the RTX 4060 Ti, for example, beats the previous generation RTX 3060 Ti, but the differences—especially when you don't factor in DLSS 3's frame-smoothing technology—are rather muted.

Another complaint is about the lack of VRAM capacity. I wrote about the VRAM topic back in July (see issue 218), but there's a valid argument that Nvidia cut the design of most RTX 40-series GPUs too far. If we were still being plagued by cryptocurrency miners buying up all our gaming GPUs, maybe the 128-bit memory interface on the RTX 4060 and 4060 Ti would make sense. But in a post-Ethereum mining world where most cryptocoins are struggling to break even on power cost versus coin value, the reduction in raw memory bandwidth and capacity looks bad.

> The reduction in raw memory bandwidth and capacity looks bad

Nvidia's half-hearted answer was to release a 16GB variant of the RTX 4060 Ti. It has the same 128-bit interface, but with 2GB chips on both sides of the PCB in a clamshell configuration. How does it perform compared to the 8GB card? Nvidia's internal benchmarks show identical performance across a suite of 16 games, while in two more games it tested the 16GB card at higher settings, and thus we don't have apples to apples data points.

Perhaps more damning is that when we reached out to multiple graphics card vendors (including Asus, Gigabyte, MSI, and Zotac), no one had plans to sample reviewers with cards. Several companies even said that given the negativity around the RTX 4060 Ti, they did not see a need to seed reviewers and influencers with hardware. We should have a full review ready next month with a card that we purchased at retail. We know there are games that can exceed 8GB of VRAM use at certain settings. Presumably, the 16GB card will do better in those games. However, it has the same compute and bandwidth as the 8GB, so there will likely be a big gap between the 4060 Ti 16GB and 4070.

In my testing, the RTX 4070 is over 30 percent faster than the 4060 Ti 8GB at 1440p, and it's doubtful that double the memory will come anywhere near closing that gap. Also, the $100 price hike isn't going to win friends. The Intel Arc A770, for example, had both 8GB and 16GB models, where the latter only cost $30 more. We could accept a $50 increase for the 16GB card, but $100 puts it too close to the 4070, which we've already seen go on sale for as little as $560.

Bumping up the VRAM interface and capacity one notch on each of the RTX 40-series GPUs (other than the 4090) would have gone a long way toward stemming complaints. Unfortunately, that ship likely sailed back in 2021, during the final design stages for the Ada Lovelace architecture.

Jarred Walton has been a PC and gaming enthusiast for over 30 years.

THE LIST

THE BEST WIRELESS HEADSETS FOR GAMING

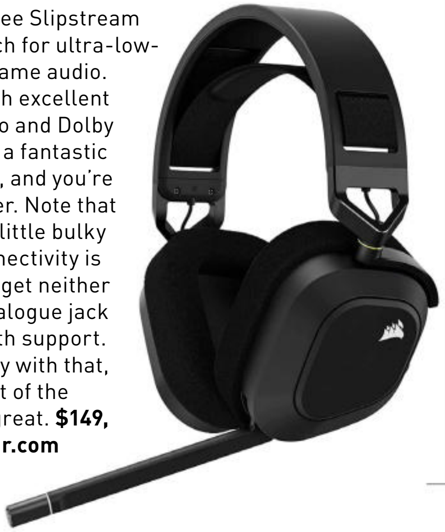
EXCELLENT AUDIO without the anchor of a cable tying you to your desktop. That's the starting point for a good wireless headset for gaming. Next up, there's battery life. Some will last a few days on a single charge. 30 hours of battery life is a decent starting point, but others will go hundreds of hours. Yes, really. Then there's the whole Bluetooth versus Wi-Fi thing. Bluetooth is often used only as a battery-saving option because, as a gamer, you want that essentially lag-free 2.4GHz WiFi connection instead.

5 JBL QUANTUM TWS

Not too bad price-wise, the JBL Quantum TWS earbuds come with dual-connection, great noise cancelling, and easy touch controls. Thanks to ultra-low latency, they're fantastic for gaming and less bulky than a headset. They're not the best-sounding buds we've tested, but there's enough bass to blow out your eardrums. The noise cancelling is decent, too, even if it inevitably cuts down the battery life from an already unspectacular eight to a borderline problematic five hours. **$150, www.jbl.com**

4 CORSAIR HS80 RGB

With a great floating headband design, the Corsair HS80 RGB is a super comfy wireless headset. It boasts the latest lag-free Slipstream Wireless tech for ultra-low-latency in-game audio. Pair that with excellent Hi-Res Audio and Dolby Atmos, plus a fantastic microphone, and you're onto a winner. Note that the feel is a little bulky and the connectivity is limited. You get neither a 3.5mm analogue jack nor Bluetooth support. If you're okay with that, then the rest of the package is great. **$149, www.corsair.com**



3 AUDEZE MAXWELL

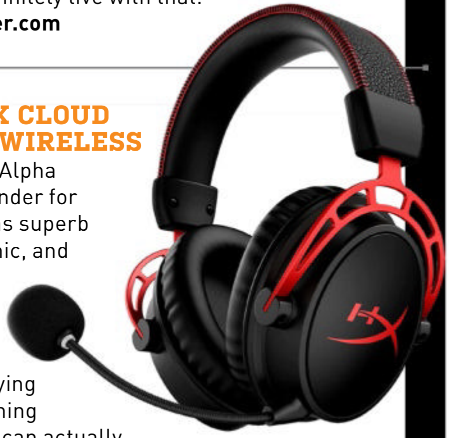
Audiophiles will be pleased with the Audeze Maxwell's planar magnetic drivers. They're expensive, but deliver gorgeous, natural sound, even if their larger magnets make for a heavy headset at 490g. Add fast charging, great battery life, and a good mic, and there's little to dislike. You also get four connectivity options, including a 3.5mm jack, USB type-C, Bluetooth 5.3, or 2.4GHz Wifi. **$299, www.audeze.com**

2 RAZER BLACKSHARK V2 PRO

Comfy, reliable, and with a good battery life, the V2 Pro is a fantastic refresh of an old favorite. The TriForce driver design apes the fantastic HyperX Cloud Alpha headset and matches its fantastic audio delivery. They're also super comfortable, and having a physical volume dial is useful. Our only issue is that the boom mic is a little weak, but now the price has fallen to $130, we can definitely live with that. **$130, www.razer.com**

1 HYPERX CLOUD ALPHA WIRELESS

The Cloud Alpha is a wireless wonder for PC gaming. It has superb sound, a clear mic, and DTS surround. Music sounds amazing and the directional sound when playing games is if anything even better. You can actually navigate around games using noises with these impressive cans. They're also light and comfy, with a whopping 300-hour battery life. It's without any doubt the best wireless headset we've tested so far. **$200, www.hyperx.com**



© HYPERX, RAZER, AUDEZE, CORSAIR, JBL

Jeremy Laird

TRADE CHAT

PC parts prices are mostly back to normal

TALES OF INFLATIONARY WOE continue, but happily the latest figures for the US dipped just under three percent. If anything, many PC component prices have been falling. Indeed, Amazon's recent Prime Day fire sale was packed with low-priced PC parts, with one predictable exception.

Perhaps the most conspicuous bargain involves storage. SSDs are pretty much being given away, with decent 512GB drives at under $30, a high-performance 1TB model like the WD SN850X for $55, and quality 2TB options for under $100.

I even saw a 4TB that was going for just over $150. Okay, it was an older Gen 3.0 model from TeamGroup that tops out at about 3GB/s. But outside of a few edge-case workflows, you're never going to tell the difference in experiential terms next to a Gen 4 SSD that's twice as fast on paper.

Meanwhile, 32GB of DDR5-6000 can be had for about $75. As for CPUs, $200 or so buys you something decent, like a six-core AMD Ryzen 7600. Spend a bit more, and you can have an eight-core last-gen 5800X model for under $240.

There's also the Ryzen 5 5600X3D with its gaming-friendly V-cache that can only be bought at MicroCenter stores. At $230, it's a lot of chip for the money. On Intel's side, $220 buys you a Core i5-12600KF. Throw in a half-decent motherboard for about $100, and you're most of the way there.

Even a decent screen is cheap. One of the best Prime Day deals I saw was an MSI 27-inch 1440p panel with 170Hz refresh for $179. Speaking of MSI, they will also do you a 32-inch 4K 60Hz panel that's perfect for productivity for $270. Samsung's M7 4K 32-inch "smart" monitor is barely any more money at $299. The M7 isn't just 4K; it has USB-C with 65W of power delivery for single cable connectivity, TV apps, mirroring support, and a remote.

> You can refresh your PC's components, and add a quality 4K monitor, for $750 all in

TEAMGROUP Team
M.2 Series Solid State Drive
Warranty void if removed
NVMe PCIe
5 YEARS WARRANTY
TM8FP4004T0C101
TPBF-190221008-1-190923
S/N : TM11-19021903500001
Rated : DC3.3V;2.5A
Model : TM8FP4004T

$159 for a decent 4TB SSD? Now that's a good deal.

Okay, the latest mini-LED and OLED panels cost tons, but none of the screens I've mentioned are remotely low rent. Anyway, the net result is that you can refresh your PC's components, and add a quality 4K monitor, for $750 all in. Add another $80 if you need a new PSU. That's pretty good, isn't it?

But there's a catch: GPUs. Nvidia's most recent graphics card launches were both aimed at 1080p gaming, and yet the GeForce RTX 4060 Ti is priced at $399 and the feeble RTX 4060 at $299. Nvidia's cheapest current GPU that's marketed for 1440p gaming, the RTX 4070, is $599. How any of that makes sense in the context of sub-$200 1440p high-refresh monitors, I have no idea.

The closest you'll get to a GPU priced in line with current monitor tech are AMD's 6700 XT and 6750 XT boards. The former dipped as low as $299 on Prime Day, but went up to over $300. Sadly, they won't be available for much longer, and it seems unlikely that their replacement, likely branded Radeon RX 7700 XT and expected to launch this year, will be as cheap. After all, the 7700 XT's Nvidia competition starts at $599.

To put that in further context, there was a 27-inch 1080p ASRock gaming monitor capable of 165Hz for under $100 during the Prime fire sale, but Nvidia expects you to pay four times as much for a 1080p GPU. Funnily enough, there were some laptop deals with decent gaming graphics, including MSI's 15-inch Katana with RTX 4070 graphics for around $1,150. Gaming hardware doesn't automatically result in price gouging.

Anyway, while it's tempting to get bogged down in the narrow negative narrative involving graphics cards, the broader story is what matters. The PC has almost entirely recovered from the external shocks that sent prices spiralling, and once again there's excellent value to be had for most PC enthusiasts. Hooray.

Six raw 4K panels for breakfast, laced with extract of x86... Jeremy Laird eats and breathes PC technology.

© CREDIT

DOCTOR

THIS MONTH THE DOCTOR TACKLES...

> Fix toner error
> Android backups
> Retro tidy up

Safe mode networking

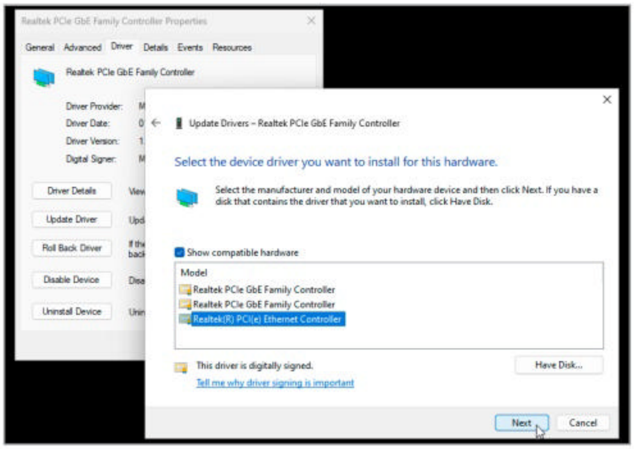
I want to perform a full security scan in Safe mode to be sure that there isn't something nasty buried in my system (nothing shows up in normal mode, but I'm not convinced). I want to boot into Safe mode with networking so I can update all my scanners, but while I did this with no problems a few years ago, I'm now unable to access the internet after rebooting into Safe mode via msconfig using the 'Safe boot' check box with Network selected.

I checked my network adapter (Realtek PCIe GbE Family Controller) in Device Manager, and it has thrown up the following error: "The driver was not loaded because the system is booting into Safe mode." I've never seen this error before, and updating the driver has had no effect. Is this a sign of possible infection?

—Bruno Casas

THE DOCTOR RESPONDS: No, it's not. What's happening is that some of the very latest network drivers haven't been written to accommodate Safe mode, so won't work even when you choose networking when booting into Safe mode. Thankfully, there is a solution you can apply from within Safe mode—choose a different, albeit older, driver. Navigate to the Driver tab of your adapter under Device Manager and click 'Update Driver' as before, but this time choose 'Browse my computer for drivers', followed by 'Let me pick from a list of available drivers on my computer'.

You'll be presented with a list of matching drivers—the one you want is 'Realtek(R) PCI(e) Ethernet Controller', which dates from 2015. Click Next to install it, and you should see the exclamation mark vanish from Device Manager to indicate that this driver works in Safe mode. Better still, you'll regain internet access.



Select the device driver you want to install for this hardware.

Select the manufacturer and model of your hardware device and then click Next. If you have a disk that contains the driver that you want to install, click Have Disk.

☑ Show compatible hardware

Model
Realtek PCIe GbE Family Controller
Realtek PCIe GbE Family Controller
Realtek(R) PCI(e) Ethernet Controller

This driver is digitally signed.
Tell me why driver signing is important

Switch to a network driver compatible with Safe mode.

When you next boot back into Windows, repeat the process to restore the driver to the latest version. The only difference is that this time, you should leave 'Search automatically for drivers' selected to have Windows reapply the latest version.

Toner doesn't show

After seeing the jaw-dropping price difference between original and compatible toner cartridges for my Brother printer, I purchased a compatible toner from a reputable supplier, which until recently worked flawlessly. When I came to switch on the printer , however, I was greeted by a 'No toner' error message, even though when I last looked there was 90 percent of toner left.

I've tried all the recommended fixes: removing and reinstalling the cartridge, checking the contacts on the toner chip, and so on. I've done some research, and have no memory of applying any firmware updates. If I swap the cartridge for my original Brother cartridge, which I still have (but is now empty), it recognizes the cartridge, but swapping back doesn't work. Any ideas?

—Larry C Bowles

THE DOCTOR RESPONDS: This behavior has been known to occur after a power outage, and Larry confirmed that he'd suffered a brief outage a few hours before discovering the problem with his printer. It appears the power failure has fried the cartridge's chip, so it no longer functions. Luckily, he has the original cartridge with a genuine Brother chip, and it's easy to swap out the chips, allowing him to fix

© MICROSOFT

↘ submit your questions to: doctor@maximumpc.com the chip from the original cartridge to the new one.

It's a relatively simple task: you need a small flat-bladed screwdriver to lever the two chips out of their cartridges—they bear a superficial resemblance to a mobile phone SIM card, and you'll find them on the right-hand side of the cartridge when it's flipped over. Neither is screwed into place, so ease each one out using the screwdriver, then swap them over, making sure the contacts are facing up.

Once he'd performed this step, Larry was able to report that the toner cartridge worked again. If for any reason the cartridge is recognized but now claims to be empty, you can reset the counter via your Brother's control panel. The exact steps vary by model—Google your printer model and the words "toner reset" to track down instructions.

Back up Android

I'm a long-time reader/subscriber of both the print and digital editions. I took your advice several years to build a back-up solution for three PCs using the paid edition of Macrium Reflect, running weekly full backups and daily differential backups to a NAS. This has allowed me to recover from several catastrophic hardware failures quickly and easily, and to clone systems to new hardware. Macrium makes it easy to 'mount' a backup to recover individual files as well. It's a great solution.

Now, I want the same thing for my two Samsung Galaxy smartphones. However, I can't find anything remotely like Macrium Reflect for Android. I've contacted Macrium, and it has no plans to address this requirement. Acronis claims to have a solution for Android, but it failed repeatedly when I tested it over my in-house Wi-Fi. The other so-called 'backup' apps seem to focus on syncing specific file types to a cloud server, which is not what I'm looking for.

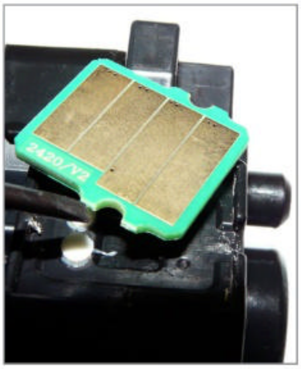
Why is this so easy for Windows and so hard for Android? **—Brad Grigor**

THE DOCTOR RESPONDS: There are several stumbling blocks that make taking a complete backup of Android phones impossible, not least the fact that they'd need to be rooted, as well as the impractical nature of backing up a system over Wi-Fi on a phone running on batteries.

You'll need to limit yourself to a two-stage back-up plan: the first continues to back up your key data and settings over the cloud using Google's built-in option. The second involves regularly connecting your phone to your PC using a USB cable, enabling USB debugging mode, then employing one of two options.

The simplest option is a tool like Dr Fone from https://drfone.wondershare.com/ (scroll down and click Android Backup under Phone Backup). You can back up your phone for free, but should you need to restore your backup, you'll need purchase Dr Fone Basic, which costs $49.95. Dr Fone can back up 11 types of data from your phone, from photos and videos to applications (including all app data), call history, messages, and contacts. It's simple to set up and use, and you'll have a single compressed back-up file on your PC, which Dr Phone Basic can restore not just to your current phone, but a newer model too.

Alternatively, you could install Android Studio on your PC, which includes a copy of the Android SDK platform. This contains a tool—adb—which can back up system files, as well as application data (and optionally, applications), but it doesn't include the other items covered by Dr Fone Basic. Visit https://forum.xda-developers.com/t/guide-full-phone-backup-without-unlock-or-root.1420351/ for a guide to using it once you've installed the full version of Android Studio (https://developer.android.com/studio). Uncheck 'Android Virtual Device' during setup. Once installed, open Android Studio, which will run you through another setup wizard. When prompted for the components to install, uncheck everything except 'Android SDK' at the top.



Try swapping toner cartridge chips to fix 'no toner' errors.

Once in place, with your phone connected, close the main Android Studio window, right-click Start, and choose Terminal (Admin). Issue the following commands:

```
cd AppData\Local\Android\sdk\platform-tools
```

You can now run the adb command (it needs to be prefixed with .\ in order to work)—for example, the following backs up system and app data to your D drive:

```
.\ adb backup -all -f D:\android-backup.ab
```

Should you ever need to restore the backup:

```
.\adb restore D:\android-backup.ab
```

It's not as comprehensive as Dr Fone, and the feature has already been depreciated, so the Doc suggests giving Dr Fone a try and seeing how you get on.

Clean up Batocera

I loved your feature on creating your own gaming PC, and have set up Batocera on a USB stick so I can play classic games at home and relive old favorites. My only niggle so far is that several games come on more than one disk, so appear multiple times on the game-list screens. Is there a way to merge—or at least hide—the other disks? **—Jessie Rust**

THE DOCTOR RESPONDS: There's no one-size-fits-all approach, but broadly speaking it involves creating M3U playlist files for those systems that support it—we tested them successfully with Atari ST, Amiga, and several console platforms, but it didn't work with the ZX Spectrum.

Thankfully, you can create m3u (and other text) files from within Batocera. Press F1 to open Batocera's File Manager (PCManFM). Open Roms and navigate to the directory containing your multi-disk game. Now, right-click inside this folder and choose Create New... > Empty File. Name it <game title>.m3u, substituting <game title> with your choice of game—for example, Civilization.m3u.

Make a note of each disk's filename. Double-click the m3u file you created and populate it with the names of each disk like so:

```
Game Title (Disk 1).adf
Game Title (Disk 2).adf
```

Choose File > Save followed by File > Quit. Press Ctrl + Q to return to the main Batocera window, press the Space key and choose Game Settings > Update Gamelists. After the rescan completes, you should see the multiple disk entries have vanished to be replaced by a single entry you can now scrape with metadata like any other.

Depending on the platform you're creating playlists for, they may automatically load all the disks in the correct order; otherwise you'll need to continue swapping disks manually when prompted. For more information on this, check the Batocera wiki (https://wiki.batocera.org/cd_image_formats).

RTX FOR UNDER $940

Intel 13th Gen & Nvidia 40-series at a bargain price

WHETHER YOU'RE deciding to upgrade your setup or start afresh, choosing between high-spec last-generation components or current-generation futureproof parts can be tough. We wanted to follow the latter path while also staying under the $1,000 mark. With this in mind, we kicked things off with the cheapest 13th-generation desktop CPU offering from Intel, the i3-13100F. As we also want to use a dedicated graphics card, we went for the F variant without the integrated Intel graphics to save money. After all, you're going to want some snacks on your desk too, right?

Anyway, this humble i3-13100F does sit at the bottom of the hierarchy for Intel's desktop CPU lineup. However, we're giving it a chance to see if it's worth entering the 13th gen Intel-sphere via this route or if you should opt for a higher spec. It's a quad-core chip, and focuses all of these cores on performance, unlike other Raptor Lake CPUs that have a hybrid architecture, combining performance and efficient cores. At $109, it's an affordable gateway into the latest tech from Intel, comes with a stock cooler, and should pair well with our chosen GPU for 1080p gaming.

Seeing as we have chosen the cheapest Intel 13th gen chip, how about applying that thinking to the graphics card? We've gone with an RTX 4060, specifically the MSI Ventus 2X Black OC GPU. At a cent less than $300, we can get the latest generation of CPU and GPU for just over $400, leaving us with nearly $600 to play with.

As we didn't want to go down the Mini-ITX route, an ATX board was required. Choosing a DDR5 compatible mobo and finding some DDR5 RAM would have pushed us over budget, so we went for an NZXT Z690 board, which at the time was on sale, and paired it with some DDR4. This memory is powerful enough to work with our budget-end CPU/GPU combination. We also wanted this build to look the part, so all of this is housed in a sleek NZXT H5 Flow case. To aid further with cooling, we brought in NZXT's F140 RGB Duo fans, which should provide us with some fancy lighting, too! With all this said, let's see if we can achieve a 1080p next-gen gaming system on a budget with the latest gen components.

INGREDIENTS

PART		STREET PRICE
CASE	NZXT H5 Flow	$83
CPU	Intel Core i3-13100F	$109
CPU COOLER	Intel Laminar RM1	N/A
CASE COOLING	NZXT F140 RGB Duo	$35
MOBO	NZXT N5 Z690 ATX	$150
GPU	MSI VENTUS GeForce RTX 4060 2X BLACK OC 8GB	$300
MEMORY	16GB (2x 8GB) Corsair Vengeance RGB RS DDR4-3200MHz	$60
SSD	1TB ADATA XPG GAMMIX S70 Blade PCIe 4.0 NVMe	$60
PSU	650W NZXT C650 80 PLUS Gold Fully Modular ATX	$110
OS	Windows 11 Home 64-bit OEM	$32
TOTAL		**$939**

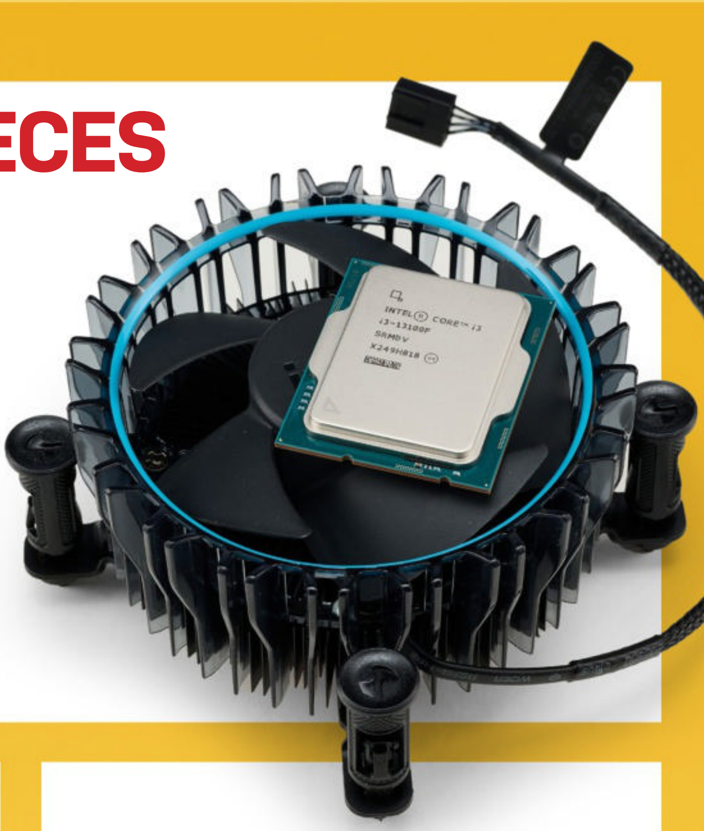
PRICES CORRECT AT THE TIME OF PRINTING

https://content.jwplatform.com/videos/GT7yHf6s-u2lN49He.mp4
Please type this URL into your browser if the link is broken

BUILD IT PG. 22

msi
GEFORCE RTX
NZXT

THE PUZZLE PIECES



CPU $109, www.intel.com

• INTEL CORE I3-13100F

The humble gateway into the 13th generation Intel line-up. This quad-core processor is the cheaper variant of the standard Intel Core i3-13100, as it doesn't feature integrated graphics, but this saves us some extra bucks! Plus, we've got something better than integrated graphics lined up for this build. This chip should be a great starting point for a next-gen system.

GPU $300, www.msi.com

• MSI GEFORCE RTX 4060 VENTUS 2X BLACK 8G OC

Here it is then, the better alternative to integrated graphics: our MSI RTX 4060 GPU. Like the Intel chip, this is the gateway into the next-generation Nvidia 40 series line-up. With DLSS 3.0 support, we should be able to get some high FPS on supported titles with this budget card.

CPU Cooler N/A, www.intel.com

• INTEL LAMINAR RM1

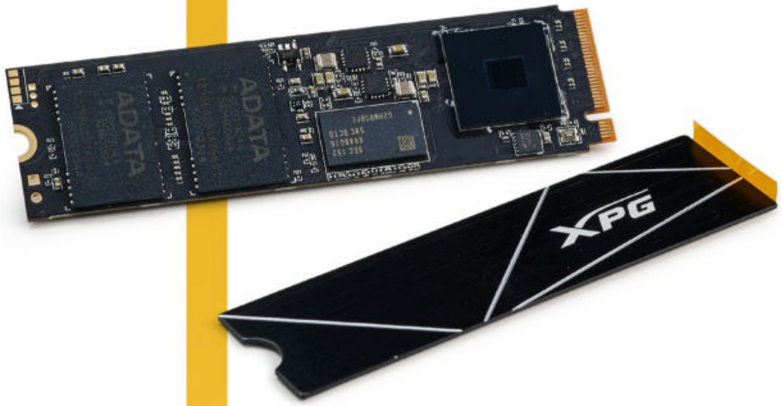
Bundled in with our Intel Core i3-13100F comes the Laminar RM1 stock cooler. A great-looking CPU fan, far better than the previous model, and enough to keep our low-powered CPU nice and cool. Using this again has saved us a lot of our budget!

BUILD IT PG. 22

SSD **$60, www.adata.com**

• 1TB ADATA XPG GAMMIX S70 BLADE PCIE 4.0 NVME

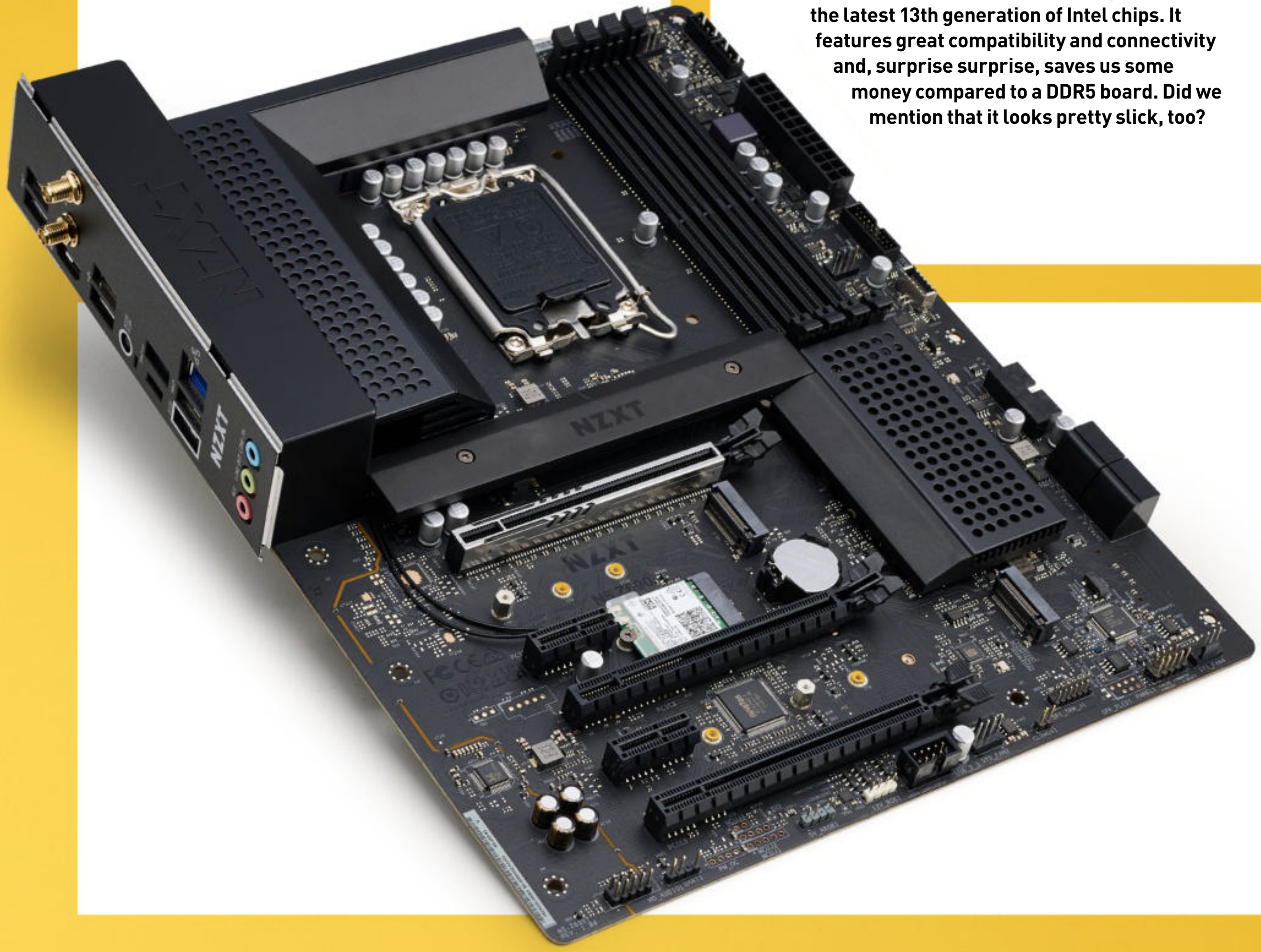
At $60, this is a super-snappy SSD to pick up in this price range. With read/write speeds of up to 7,400/6,800MBs, it'll make data transferring a breeze on this system. 1TB is also plenty of storage, but if you wanted to double up, you can pick one up for around $110. Again, this is a great pick-up for the money.



Motherboard **$150, www.nzxt.com**

• NZXT N5 Z690 ATX

Although it doesn't support DDR5, it's a fantastic motherboard that's compatible with the latest 13th generation of Intel chips. It features great compatibility and connectivity and, surprise surprise, saves us some money compared to a DDR5 board. Did we mention that it looks pretty slick, too?



Memory $60, www.corsair.com

• 16GB (2X 8GB) CORSAIR VENGEANCE RGB RS DDR4-3200MHZ

By picking a DDR4 mobo, this of course saved us money, too. DDR4 RAM is still a great choice, especially paired with the more budget-end-oriented system we have here. The RGB should add some ambiance to the case, too—that's a win-win.

VENGEANCE
VENGEANCE

Case $83, www.nzxt.com

• NZXT H5 FLOW

This minimalist chassis certainly adds an essence of premium to our build. It's not all style here, though; there's plenty of substance in this case. It's very easy to take apart, has a multitude of cable channels, a great build quality, and a bottom intake chamber fan that angles up towards the motherboard. Pretty cool!

BUILD IT PG. 22

PSU **$83, www.nzxt.com**

• 650W NZXT C650 80 PLUS GOLD FULLY MODULAR ATX

This isn't necessarily overkill; just more on the safer side of things. 650W is enough to cover the power output of our system, but it leaves us with room for improvement down the line.

Case Cooling **$35, www.nzxt.com**

• NZXT F140 RGB DUO

As our case had nothing in the front grille, we thought we ought to change that. In comes two 140MM RGB fans from NZXT to bring some wow factor to the mix. That comes second to the air they'll be breathing in, but still, they'll look the part, too.

CURRENT-GEN ON A BUDGET

SHOULD YOU GAME ON ENTRY-LEVEL 2023 GEAR?

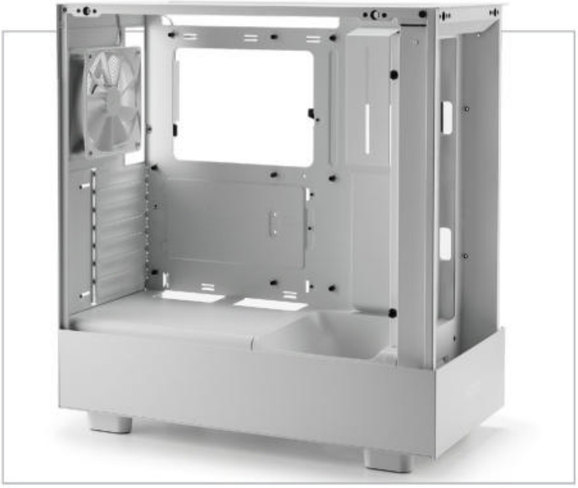
msi
GEFORCE RTX

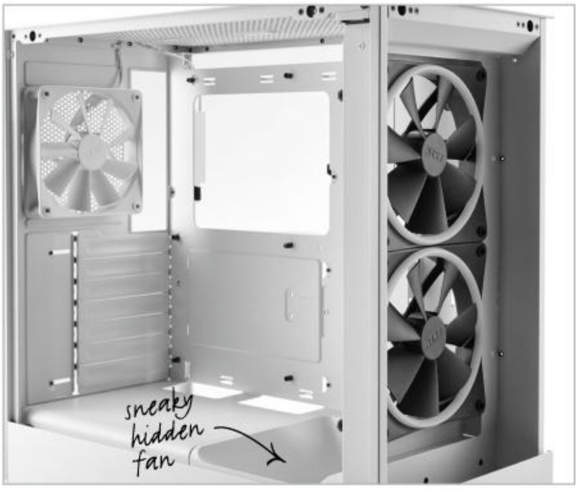
LENGTH OF TIME: **1-2 HOURS**
LEVEL OF DIFFICULTY: **EASY**

1 THE CAGE

TO UNDERSTAND OUR BUILD FULLY, we begin by looking at the core of our case. It allows us to see exactly what we're working with, and should prevent any further panels/covers from being removed later down the line. Then, towards the end, we'll put all the panels back on to avoid going back and forth throughout the building process.

To remove the front glass panel, there's one black thumbscrew at the top that you loosen, then pull the metal tab next to it towards you to remove the glass panel from the case. We always keep this somewhere safe until we need it later, like the original box. As for the back panel, this has two black thumbscrews: one at the top and one at the bottom. Un-tighten these and slide to remove this panel. Last but not least, we need to lift off the magnetic mesh panel at the top and the front grille. This simply pulls off from either side—be careful to avoid snapping any clips.

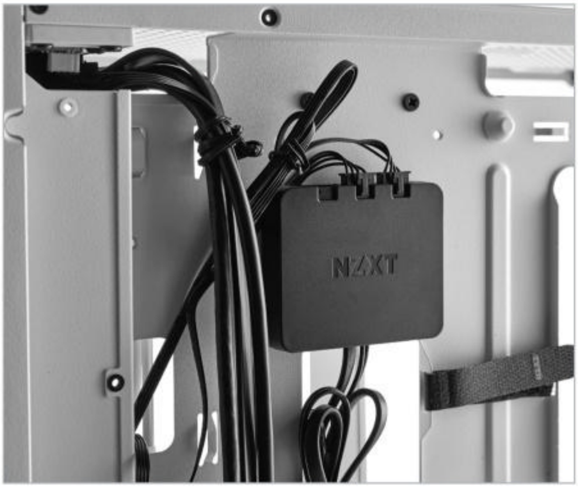




2 EXTRA COOL(ING)

AS WE AREN'T USING a fully fledged AIO cooler in this build and our case has no lighting, we thought we'd use some RGB fans to combat both of these issues. To fill the space fully, we went along with two 140mm fans from NZXT. We'll be installing these both in the front grille of the case. We placed the case on its back to make this process easier—the fans sat on the mounting rack facing outwards—and secured them on from inside the case.

The faces of the fans point outwards, as these will be used as an intake. When it comes to fans, faces suck, and we needed the airflow to run through the case across the components. We kept the original NZXT H5 Flow fan at the back as an exhaust fan. This case also has a hidden fan that sits at the bottom of the case, and it angles upwards towards the motherboard that also acts as an intake.



3 CONTROL THE FANS

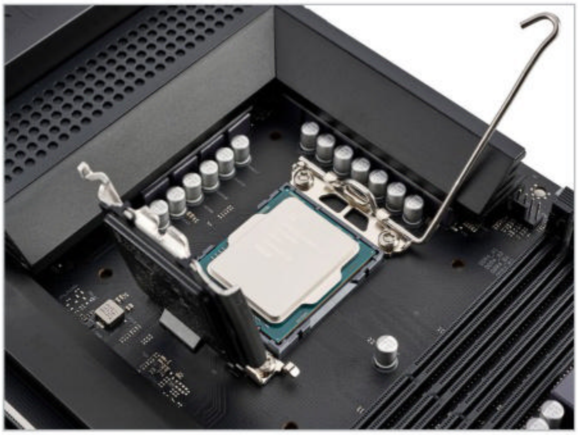
RIGHT, OUR FANS ARE IN, but without a fan controller, they won't perform how they should. This RGB fan controller comes included with the NZXT F140 RGB Duo kit, and can be used with up to three RGB fans. Each fan comes with a standard fan cable that will connect to the motherboard and an RGB cable that connects to the controller. It's as simple as clipping the cables in and sticking the box wherever seems appropriate on the case.

As the controller is magnetic, we didn't need to use any adhesive tabs, although these are provided in the box. We placed our controller onto a flat space towards the top left of the back of the case. This way, we could keep the RGB cables tidy with some simple cable management. The controller connects to the motherboard via a USB cable and is powered via SATA, which we'll sort out later.

4 THE MOTHERBOARD'S BRAIN

WE CAN NOW MOVE the case to the side for now and start adding most of our components to the motherboard. Whenever working on the motherboard, we like to do this on top of its original box—obviously you won't see that, as it doesn't make for the most aesthetically pleasing shot, but it helps protect the back of the motherboard. Anyway, we're going to add arguably the most important part of the build first, the CPU. If you have a brand new motherboard, the CPU socket will have a protective plastic cover on it. You don't need to remove this yet, as it will pop off automatically.

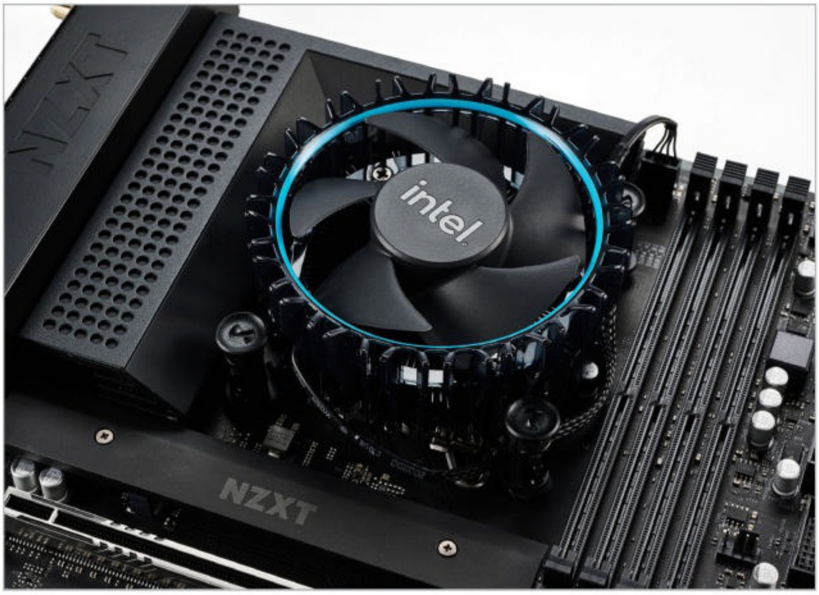
Open up the bracket by un-hooking the retention bar and raising it. Then, while holding the sides of the CPU carefully, lower it down into the socket, making sure the arrow on the CPU points towards the corresponding arrow on the motherboard. Then, with it in place, we can hook the retention bar back to where it originally was. This will pop off the protective cover in the process.



5 BRAIN FAN

AFTER INSTALLING THE CPU, we will add the last part of the cooling puzzle for this build: the CPU stock cooler. As we mentioned earlier, this came packaged up with our Intel Core i3-13100F. It also came with some pre-applied thermal paste, so be careful not to touch this when installing. If yours doesn't have this, or you're reusing one, place a pea-sized amount of thermal past directly in the center of the CPU before installing.

This stock cooler doesn't require a backplate to be installed; it clips in place using the four pegs of the cooler. Line these up with the holes on the motherboard, and push each peg down, working diagonally. You'll hear a satisfying click when it's in place, then you can connect the cable up to the CPU fan header on the motherboard.



6 RANDOM ACCESS MEMORY

TO OPEN 18 CHROME TABS AT ONCE, you need RAM—well, that's all it's used for, right? Okay, don't quote us on that, but inevitably we need to install it. Thankfully, adding the RAM is one of the easiest parts of the build process. But before we get clicking things into position, we need to work out what DIMM slots to use, as we only have two sticks available and a total of four slots. Typically, if you're using two sticks, these go in slots two and four, but always check your motherboard's official manual to make sure.

Installing the sticks is as simple as opening the clips on the slots and pushing the sticks down, making sure the notches line up. You'll then hear a loud click when they're firmly in place.

intel
VENGEANCE

7 OUR STORAGE

USUALLY, when adding an SSD, we would use the uppermost M.2 slot available on the motherboard. However, as we have an SSD that we have previously used that has a heatsink installed already, this wouldn't quite fit underneath the NZXT heatsink on the mobo, so we used the second slot. Now, this can affect the performance, so always make sure you check the specifications of each of your M.2 slots. For us in this build, this won't impact performance all that much.

On the plus side, it makes this step even easier. We first need to get an M.2 screw from the motherboard's box before we start—keep this safe, as these are very difficult to find if you drop them. Place the port end of the SSD into the socket on the board, and lower it down flat so that the screw hole aligns with the notch on the SSD. Then, with the SSD in place, use a small-headed Philips screwdriver and the M.2 screw to secure it down.

8 INTO THE CHASSIS

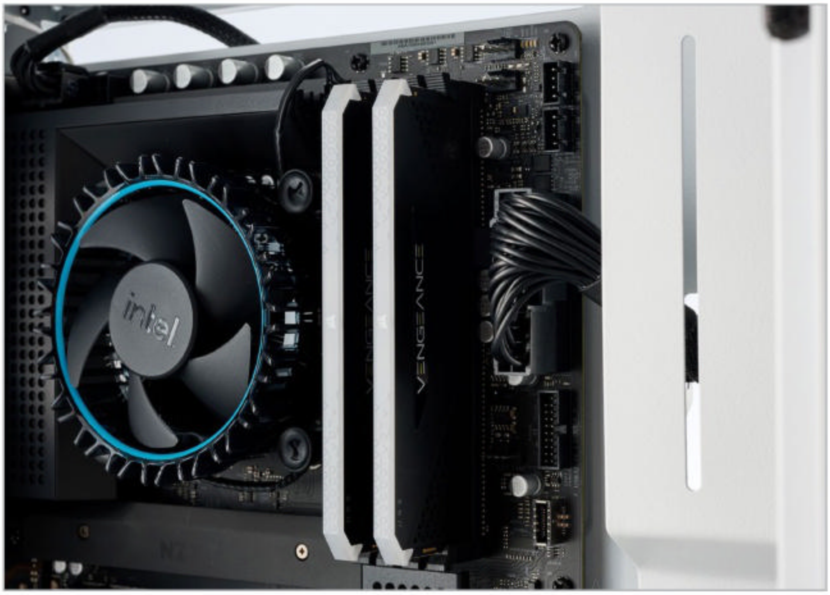
WITH EVERYTHING but the GPU installed onto the motherboard, we can add this to the case at this stage. To make life easier, lay the case flat on its back when doing this. We recommend laying some cardboard underneath the case to protect it from any scratches. To install, first make sure that you have all the correct standoffs in place before you begin. Then, carefully lower the motherboard down into the case with the I/O panel going in first, into the back of the case.

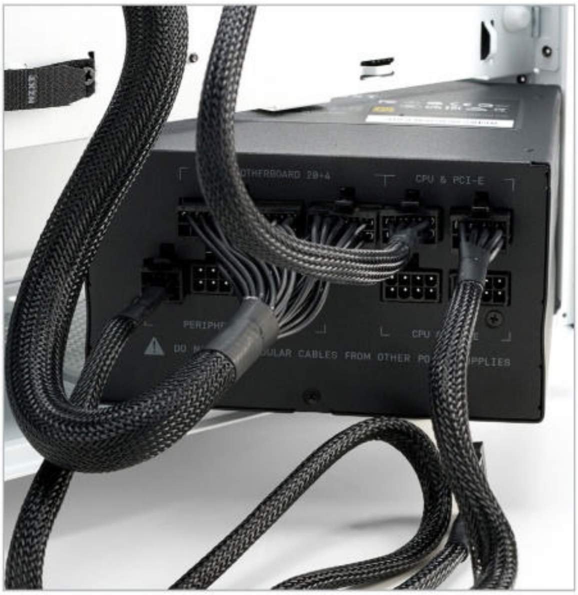
With the board resting flat, make sure the screw holes line up, then you can start to secure it using a skinny magnetic Philips screwdriver. Dropping screws in tight places at this point can be very frustrating, so make sure they don't fall off your screwdriver. Also, work diagonally to keep an even tension across the mobo, and be sure to use as many of the available screw holes as possible.

9a PSU CABLES

BEFORE PHYSICALLY INSTALLING the power supply, we thought it would be more efficient to install the cables to the motherboard first, as these can often be awkward. At this stage, we only needed to install two: the cable for the CPU and the 24-pin motherboard cable. The PCIe cable will be installed when we add the GPU to the mix. We did, however, connect the SATA cable to the NZXT RGB fan controller at this stage, too.

We ran the CPU cable straight over the top into the top-left corner of the case and down the side using the provided NZXT cable management velcro loops. As for the 24-pin motherboard cable, we ran this behind the cover that sits to the immediate right of the motherboard and then down through some more velcro loops.





9b PSU CABLES CONNECTED

WITH THE NECESSARY CABLES connected to the motherboard and the NZXT RGB fan controller, we can now plug them into the back of the PSU before installing that. As this case comes with the bottom-mounted intake fan, this takes up some space in the bottom chamber, so we wanted to make this process as easy as possible. As mentioned earlier, we only need one CPU cable, one PCIe cable (which we will install into the PSU at this stage), one SATA cable, and the 24-pin cable. These are all clearly labeled on the back of the power supply, but if you are ever unsure, follow the instructions in the manufacturer's official manual.

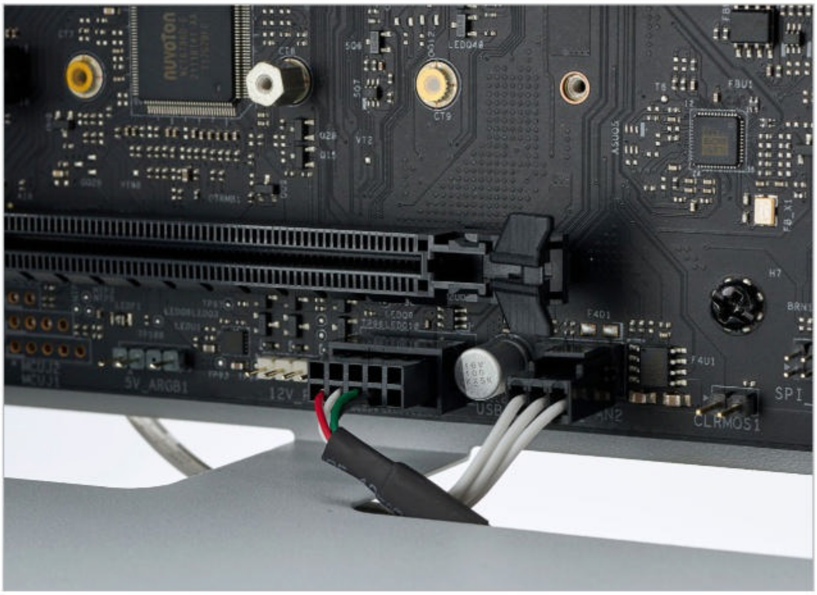
9c INSTALLING THE PSU

RIGHT, SO WE'VE GOTTEN THE CABLES in the motherboard and the back of the PSU. Now, the only thing left here is to get it secured onto the case. Push it towards the back, and all you need to make sure is that all of the screw holes align. Then, using four of the case screws and a Philips screwdriver, tighten this to the case, working diagonally. After it's in place, we can try to tidy up any cables and tuck them into the bottom of the case in any space we can find. As these cables are quite tough, they can be annoying to bend and squeeze into the space at the bottom, so take your time. If these are just sitting at the back of the case, it's unlikely that the back panel will be able to fit on.

10 FAN CABLES

WITH THE MAJORITY of components installed, we can hook up all of the fan cables. In total, there are four fans in this build, and thankfully we have enough fan headers on the board to compensate—no daisy chains here, folks! Always refer back to the motherboard manual to double-check where these are and whether you can use them. A fan cable will connect up to the AIO pump header, for example, and that's not exactly going to work effectively.

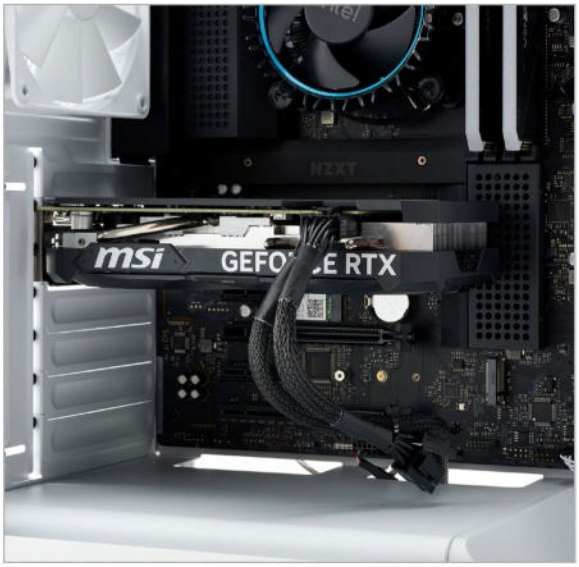
We made sure to connect the cables to the closest fan headers available so we could tidy up the excess cable around the back of the motherboard. At this stage, we also connected the USB cable to the motherboard from the NZXT RGB fan controller. This hooked up to a header at the bottom middle of the mobo.



11 GRAPHICS CARD

AS IN MOST OF OUR BUILDS, the GPU—one of the most exciting parts—has to go in last. This is because it not only secures directly onto the motherboard, but also to the case itself. To get prepared, we removed two of the shrouds from the case where the I/O part of the GPU will sit. These were the second and third from the top. Be sure to keep the screws, as we will need these again soon.

Then, with the GPU PCIe slot clip open, we can align the connector with the port and push it down until we hear a click, just like when we were installing the RAM. With the GPU on the mobo, use the screws from earlier to tighten it up onto the case. Finally, we can clip in the PCIe cable that we installed into the PSU earlier to finish it off.



VENGEANCE
VENGEANCE

12 CASE CABLES

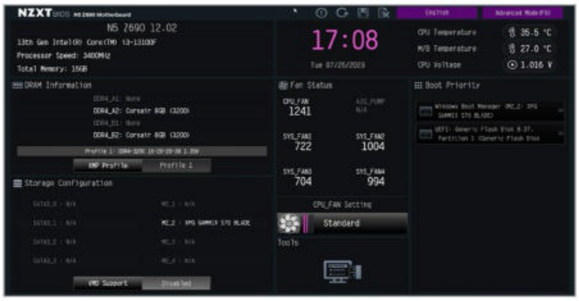
LAST BUT NOT LEAST on the hardware side of things, we need to connect up all of the case cables. These consist of power switch cables, USB connectors, and a cable for the audio so that our auxiliary port works. Again, refer back to the motherboard manual to ensure that you know where all of these cables should go. All of the headers on the motherboard are labeled, but it can be quite awkward at this stage to find what you're looking for in the case. We routed the USB cables alongside the 24-pin motherboard cable, as they connect just below it. With all of our cables, we tried to create a few routes, and then tidied them up right at the end in the back of the case.

13 COMPATIBILITY FIX

WITH ALL THE HARDWARE TOGETHER, the fun is not quite over yet, as we have to make sure this thing boots! Long story short, it didn't at first. It wasn't all doom and gloom though—everything lit up, it was just stuck in a boot cycle, so we knew we needed to perform a BIOS update. This was inevitable, as the CPU was a lot newer than the motherboard, and hopefully it would fix the boot cycle error.

As our NZXT N5 Z690 motherboard came with a BIOS flashback option, we went down this route. This required another PC or laptop. Head to your motherboard's official manufacturer's product page, and in the support section, download the latest BIOS file. Extract that onto a clean USB drive that's been formatted to FAT 32, rename the BIOS file (ROM) 'creative.rom', and delete the release notes file.

To recap, make sure the only file on the USB drive is the 'creative.rom' file, then with the newly built system off, insert this into the BIOS USB port on the back of the motherboard. Then you can turn the power supply on so the motherboard has power, and press and hold the BIOS FLBK button for three seconds until the light starts flashing. This process can take up to 10 minutes. After the system has been updated, the light should go out. Then you can boot your system up as normal and enter the BIOS.



N5 Z690 12.02
13th Gen Intel(R) Core(TM) i3-13100F
Processor Speed: 3400MHz
Total Memory: 16GB

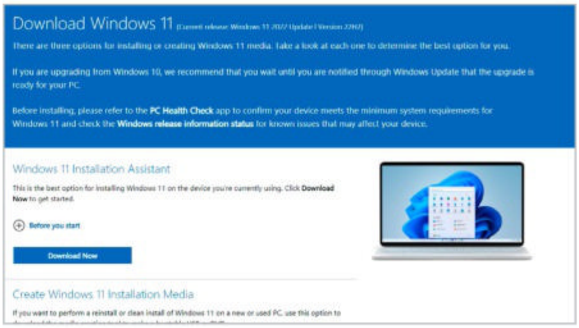
17:08

CPU Temperature 35.5 °C
M/B Temperature 27.0 °C
CPU Voltage 1.016 V

DRAM Information
DDR4_A2: Corsair 8GB (3200)
DDR4_B2: Corsair 8GB (3200)

Fan Status
CPU_FAN 1241
SYS_FAN1 722
SYS_FAN2 1004
SYS_FAN3 704
SYS_FAN4 994

CPU_FAN Setting: Standard



Download Windows 11 (Current release: Windows 11 2022 Update | Version 22H2)

There are three options for installing or creating Windows 11 media. Take a look at each one to determine the best option for you.

If you are upgrading from Windows 10, we recommend that you wait until you are notified through Windows Update that the upgrade is ready for your PC.

Before installing, please refer to the **PC Health Check** app to confirm your device meets the minimum system requirements for Windows 11 and check the **Windows release information status** for known issues that may affect your device.

Windows 11 Installation Assistant

This is the best option for installing Windows 11 on the device you're currently using. Click **Download Now** to get started.

Create Windows 11 Installation Media

If you want to perform a reinstall or clean install of Windows 11 on a new or used PC, use this option to

14 ADDING THE OS

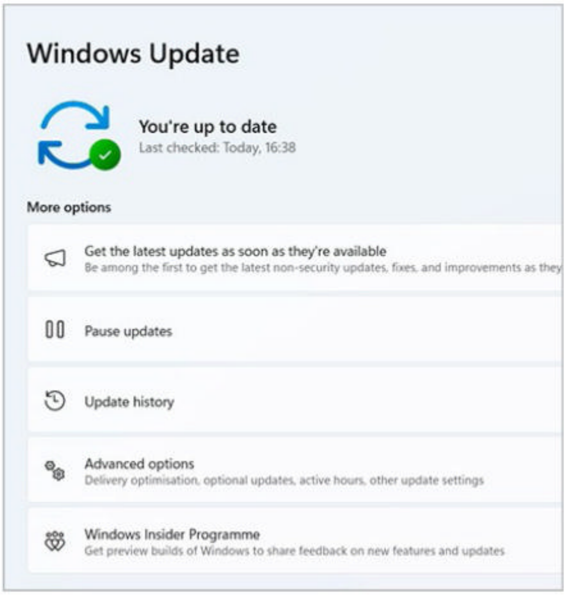
NOW WE CAN ENTER THE BIOS and proceed to get the operating system installed, which of course will be Windows 11. Providing you haven't thrown away the other PC/laptop you used earlier to download the latest BIOS file with, use that again to download Windows 11. Again, you'll need a clean USB drive that has at least 8GB of capacity and has been formatted to FAT32. Head to the 'Download Windows 11' page on Microsoft's official website, and hit the download now button under the 'Create Windows 11 Installation Media' section.

Once this has been downloaded, open up the program and follow the on-screen instructions until it gives you the installation location page. Here, select your USB drive and continue until the file has been installed. You can then safely eject the USB and connect it to your new build. Load that system up into the BIOS and re-order the boot priority, making sure that the USB drive is at the top. Save and exit from this, and re-boot once more. This should then load straight into the Windows 11 installation tool. Once more, follow the on-screen instructions to fine-tune Windows to your liking.

15 UPDATES, UPDATES, UPDATES

AFTER INSTALLING Windows and following the on-screen instructions, we can now see the glorious Windows 11 home screen. Hold up, though—don't race straight to Steam. We know you want to, but there are a few necessary updates that we need to do first. After connecting to the internet, you are going to want to head to the Windows 11 settings and perform a software update. Restart the system to install the update, and then we can get on with the next part: installing the graphic drivers for our RTX 4060 card.

If you've noticed that your system is more on the glitchier side than you'd like, a simple graphic driver update should sort this out. As we have an Nvidia card, head to the official website and download the Nvidia GeForce Experience application. Within this application, go to the Driver tab at the top left of the screen and click 'check updates'. If one pops up, download this and choose the express installation. Restart your computer afterward, and this should help with any stuttering or glitchy experiences. We always recommend using a DisplayPort cable when on a desktop that's directly connected to your graphics card in order to get the best available image and performance.



Windows Update

You're up to date
Last checked: Today, 16:38

More options

Get the latest updates as soon as they're available
Be among the first to get the latest non-security updates, fixes, and improvements as they

Pause updates

Update history

Advanced options
Delivery optimisation, optional updates, active hours, other update settings

Windows Insider Programme
Get preview builds of Windows to share feedback on new features and updates

© NZXT, MICROSOFT

INTEL 13TH GEN & NVIDIA 40 SERIES=?

IS IT WORTH ENTERING AT THE BUDGET END OF NEXT-GEN GEAR?

WE'VE MADE IT to the end of our building process. These smaller builds are less stressful than some of the mini-ITX ones—certainly less than the custom water-cooled systems. Watch this space though, as we want to hop on that train soon! Anyway, this budget-end system, like most, is fairly straightforward to put together. We luckily had no real issues, aside from the SSD, as we couldn't use the uppermost SSD slot due to the pre-existing heatsink. It just wouldn't fit with the NZXT heatsink covering it. This led to us using the second slot instead, which does have its drawbacks. We'd always recommend using the top slot. However, when we tested our SSD on our read/write speed benchmarks, it still performed very well. The Adata XPG Gammix S70 Blade is a fantastic storage option for any build, especially at its current price.

The only other issue we faced was that when we first tried to turn the PC on, it was stuck in a boot loop cycle. All the lights would turn on, and then about a minute later it would restart. To overcome this, we updated the BIOS using the flashback method, with a clean USB drive formatted to FAT32. This is our favorite method, as you don't even need to get to the BIOS to do this, or even have a CPU on the motherboard. Just hold down the BIOS FLBK button for a few seconds, and let it do its thing—not bad, hey? Anyway, this resolved our issue, and meant that we were ready to crack on with our system.

Aesthetically, we are very pleased with how this system has come together. NZXT cases, especially this one, look much more premium than the price tags attached to them. This humble H5 Flow features great cable management, a hidden intake fan in the bottom chamber, and a subtle minimalist style that matches our desired aesthetic. It can also withstand further upgrades, like a larger GPU and an AIO with radiator support of up to 280mm. With great airflow, it keeps our system running nice and cool, especially when we're gaming at 1080p.

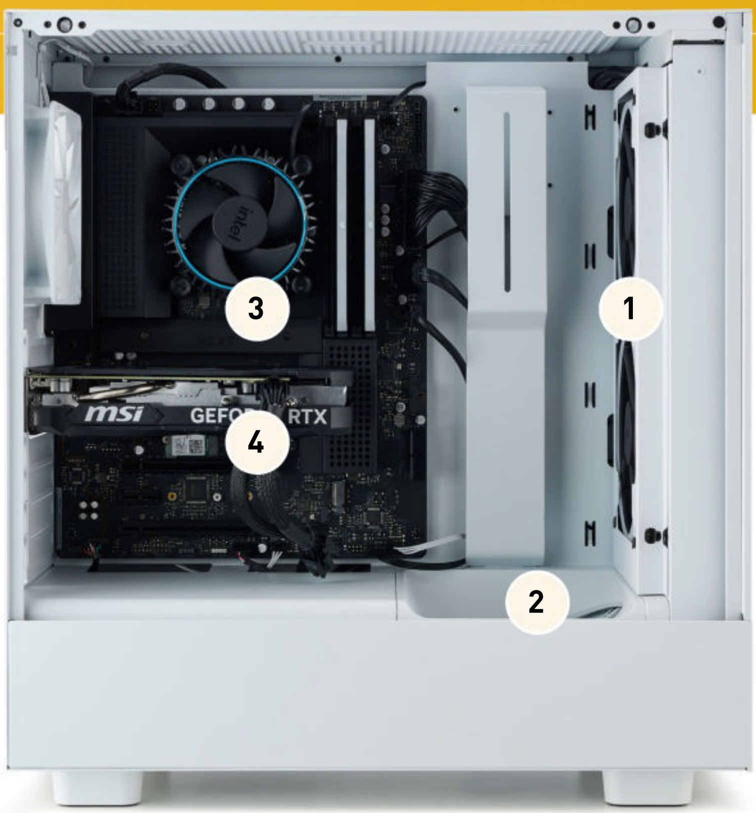
We feel that our components balance out across the whole machine. Sure, DDR5 RAM and a compatible motherboard would have helped in the long run, especially for futureproofing, but to keep our budget down, we had to go down the DDR4 route. DDR4 is still more than adequate for what we wanted, too. Working alongside the SSD and CPU, general day-to-day work on this PC feels responsive and snappy. Load times are fast, we can open up a multitude of applications at once, and it would make a strong contender for an at-home office PC. We wouldn't push this system too hard by designing very in-depth Blender creations, but for the majority of tasks, this machine does the job. You also have the peace of mind that you are working with the latest from Intel and Nvidia, so application support is on your side.

BENCHMARKS

	ZERO-POINT	
Cinebench R23 Single-Core (Index)	1,708	1,529 (-10%)
Cinebench R23 Multi-Core (Index)	12,689	7,209 (-43%)
CrystalDisk QD32 Sequential Read (MB/s)	3,552	7,085 (99%)
CrystalDisk QD32 Sequential Write (MB/s)	3,302	6,700 (103%)
3DMark Fire Strike (Index)	24,632	22,211 (-10%)
Cyberpunk 2077 (fps)	92	87 (-5%)
Metro Exodus (fps)	82	83 (1%)
Total War: Three Kingdoms (fps)	67	85 (27%)

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

Our 1080p zero-point consists of the $942 gaming PC from our May 23 issue with an Intel Core i5-13400F, an Intel ARC A750 Limited Edition 8GB, an ASRock B660M-ITX/ac, 16GB of ADATA XPG GAMMIX D45 DDR4-3200, and a 1TB Samsung 970 EVO PLUS PCIe 3.0 NVME SSD. All games tested at 1080p 'Ultra' graphics presets with DLSS/FSR and V-sync turned off. XMP/AMP for RAM speed turned on in all tests. No manual CPU overclocking.



1 To match the rest of the build, the white variant of the F140 RGB Duo fans would have suited better.

2 An RGB fan in the chamber here would have been a nice ambient touch.

3 Moving forward, we would like to use the uppermost slot for the SSD drive.

4 A custom PCIe cable here would be a much better choice than our standard one.

The all-important results

To cut a long story short, we were impressed with what this budget-end PC could achieve. We benched it alongside a recent sub-$1K machine, the $942 budget gaming PC from our May 2023 issue. As a head-to-head, that PC offered a more powerful CPU, but paired with a lower-end GPU, so it was interesting to see how these two fared up against each other. Is it worth going for a cheaper CPU and spending more of your budget on the GPU or vice-versa?

We're not going to spoil the surprise, but without comparing results, our machine performed as we hoped. Sure, it's not exactly the fastest PC ever, but it features lots of new and current features, has plenty of life left in it, seeing as it's an Intel 13th-gen system rocking a 40 series GPU, and also costs less than a single RTX 4080. Not bad right?

So let's talk about the CPU quickly again. It's a quad-core desktop chip that is the gateway into 13th gen Intel technology. For around the $100 mark, we really can't complain here. Although it doesn't have the hybrid architecture the more premium models have, it has lots of support going forwards for PCIe 5.0, runs efficiently, and comes bundled with the Intel RM1 Laminar stock cooler. It's a good package, if you ask us. It's when we directly compare it against the likes of the Intel Core i5-13400F that it faced in benchmark tests that it starts to show its weaknesses. The single-core performance wasn't too far off in our Cinebench R23 tests, with our CPU scoring only 10 percent less than the i5-13400F. However, when it came to the multi-core results, the i3-13100F was found wanting—43 percent behind, to be precise. Our chosen processor costs half as much as the i5 model, with the results to match.

We were slightly worried about the SSD speeds, as we didn't use the top M.2 slot. However, these were still very impressive. With a read speed of 7,080MB/s and write speeds of 6,700 MB/s, data transferring should not be an issue at all on this budget-end PC. It makes it a great daily workhorse, especially with a 1TB model going for $60.

As for the GPU, it's the cheapest way into the 40 series line-up from Nvidia. This MSI RTX 4060 card comes overclocked out of the box, which is handy for a small boost of performance without having to dive into settings. For under $300, it's one of the cheapest RTX cards on the market, and can provide you with solid 1080p gaming running at Ultra settings, as shown across all three of our games, beating the likes of the Intel Arc A750 Limited Edition, another current 8GB card. Where it fell ever so slightly behind was on *Cyberpunk 2077*, but as that system had a more powerful Intel Core i5-13400F CPU to help, so we are putting it down to that. If you're looking to choose between the two GPUs, we'd side with Nvidia, as this has features such as DLSS 3.0 and better ray tracing capabilities.

All in all, this budget machine proves that if you want the latest technology and the latest features, better support, peace of mind, and stronger longevity, even if you start at the lower end, you can achieve solid performance and play the latest games. We wouldn't push this too far by trying QHD gaming and certainly not 4K, but for a reliable 1080p experience, this system can handle it even at ultra settings.

Again, for smoother gaming, we would recommend dialing the sliders down, playing on either a medium/high preset, and making the most out of DLSS features, opting for the performance mode providing your games allow for it. This way, you'll be getting a higher fps on your favorite titles. We also believe that it's best to spend your money on a more powerful GPU with a less powerful CPU compared to the opposite (the PC we benchmarked against). This will result in a richer gaming experience overall. So if you want a 13th gen Intel PC with a 40 series GPU, and have a budget of around $1,000, we've shown that it's more than achievable.

GPU TWEAKING

GETTING THE FULL POTENTIAL FROM OUR NEW 40-SERIES

msi
GEF CE RTX

WHEN WE BENCHMARK, we make sure not to overclock the system (although if the GPU is an OC model, it comes slightly clocked out of the box). This ensures that we're getting a fair test of what the system will be like as you'll buy it. We also make sure DLSS/FSR and V-sync are turned off as these can benefit the results and we want our test to be on a fair playing field. However, if you're like us, you will want to get the most out of what you've paid for, and you should be able to achieve noticeable jumps in performance by doing a few quick tweaks to the GPU. Why wouldn't you at least want to give these a go?

These little helpers aren't strictly limited to our build, too—if you've got an Nvidia GPU then follow along with these setting tweaks to push your system just that little bit further. Of course, with all of these changes, be sure to keep an eye on your system temperatures. If you notice anything too drastic, then fear not—you can always revert back!

Join the conversation!

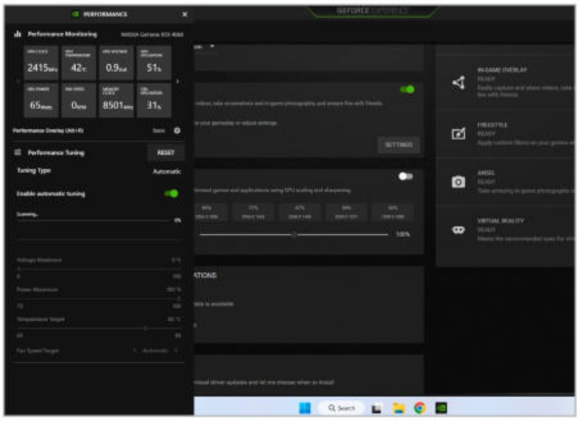
Discuss all things PC gaming with fellow readers at our official forums
forums.pcgamer.com

PC GAMER

1 NVIDIA GEFORCE EXPERIENCE

YOU'RE GOING TO NEED the Nvidia GeForce Experience application to keep your fresh graphics card drivers up to date. This will help with any bugs or performance issues, and keep your card running as it should. Not only can it help with drivers, but there's a lot that you can do to make sure the card is performing faster, too.

First, head into the settings (the settings cog icon is found in the top right of the screen). In the General tab, enable experimental features. Scroll down, and you can activate the 'In-game overlay'. This can be opened by pressing the ALT+Z keys together. In the overlay, go to performance and enable automatic tuning. This will boost your clock speed even more on your GPU—for us, it boosted it by 131Mhz. You can also activate image scaling in the GeForce Experience app—we're going to leave this though, as we are still basing our tests running at 1080p.

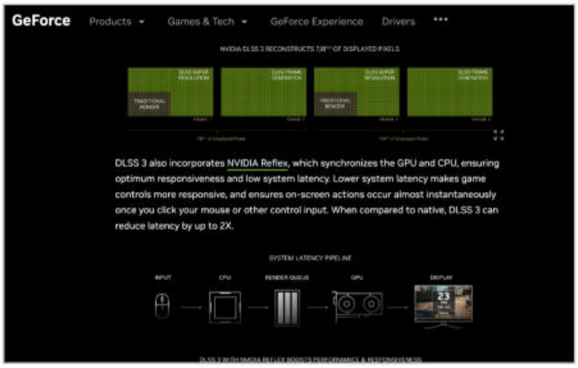


2 DLSS MAGIC

OUR MSI VENTUS GeForce RTX 4060 2X BLACK OC graphics card supports Nvidia's latest version of DLSS, version 3.0. DLSS uses AI super-resolution and Tensor Cores from the 40 series GPUs to help boost frame rates, while also increasing visual performance. Activating this should boost performance and allow us to game more smoothly on this RTX 4060. Not every game supports DLSS, but it's a common setting on most current AAA titles.

For example, *Cyberpunk 2077* has DLSS support, so we're going to turn this on to gain some extra frames. Open up the game and head into the settings. Activate DLSS Frame Generation, and under DLSS Super Resolution, select 'Ultra Performance'.

When testing at 1080p on the Ultra Ray Tracing preset, we managed to achieve an average FPS of 146. Before activating these, we were getting 39FPS. That's a gigantic leap, and really helps to make the RTX 4060 a fantastic budget card.



DLSS 3 also incorporates NVIDIA Reflex, which synchronizes the GPU and CPU, ensuring optimum responsiveness and low system latency. Lower system latency makes game controls more responsive, and ensures on-screen actions occur almost instantaneously once you click your mouse or other control input. When compared to native, DLSS 3 can reduce latency by up to 2X.

THINGS START to get even crazier when we take off ray-tracing and just play via the Ultra preset with DLSS Frame Generation and DLSS Ultra Performance activated. We managed to achieve over 200FPS on this budget-end PC on *Cyberpunk 2077*. Sure, we're running at 1080p resolution here, but visually, the game really held up and looked impressive, all thanks to a helping hand from AI.

As you can see from our results, by performing the automatic overclock on the GPU through Nvidia GeForce Experience and activating the DLSS technology, we achieved huge leaps in performance. The only figure that isn't so impressive is on *Total War: Three Kingdoms*, as there are no direct DLSS settings to activate within the game. Although it appears that just by doing an automatic GPU tune, it boosted our FPS by nine percent. As for *Cyberpunk 2077* and *Metro Exodus*, the results speak for themselves. If you need to boost performance and have a 40 series Nvidia card such as our RTX 4060, then DLSS 3.0 could well be your new best friend.

BENCHMARKS

	ZERO-POINT	
Cyberpunk 2077 (fps)	87	201 (131%)
Cyberpunk 2077 RTX (fps)	39	146 (274%)
Metro Exodus (fps)	83	110 (33%)
Metro Exodus RTX (fps)	57	99 (74%)
Total War: Three Kingdoms (fps)	85	93 (9%)

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

Our 1080p zero-point consists of the Next-gen on a budget PC from this issue with an Intel Core i3-13100F, an MSI VENTUS GeForce RTX 4060 2X BLACK OC 8GB GPU, an NZXT N5 Z690 ATX, 16GB of Corsair Vengeance RGB RS DDR4-3200, and a 1TB ADATA XPG GAMMIX S70 Blade PCIe 4.0 NVME SSD. All games tested at 1080p 'Ultra' graphics presets. XMP/AMP for RAM speed turned on in all tests. No manual CPU overclocking.

© NVIDIA, MSI

SERVICE & TUNE-UP YOUR PC

Ensure your PC remains in tip-top shape and fighting condition with the help of *Nick Peers*

ALL MECHANICAL products require maintenance to keep them running. You get your truck or car serviced at regular intervals to ensure that failing parts are spotted and replaced, while tuning the engine to improve performance and efficiency, so why not your PC too?

In this feature, we've developed a simple program to help you ensure that your PC's hardware is running as well as it possibly can. We'll start by showing you how to audit your system so you can identify everything that's in it, from the stuff you should already know about (like your graphics card model or CPU), to more obscure components (what USB controllers is your motherboard using, for instance?).

From there, we'll put in place tools that can help you monitor your system, providing you with early warnings for the parts that may be on their way out, from ageing hard drives to batteries in a state of decline. You'll learn how to identify other potential problems through stress-testing, before we switch our attention to examining ways to tune your hardware for better performance, from basic updates to judicious overclocking of selected components.

Ready to put your PC through its paces? Let's get started.

© ISTOCK / GETTY IMAGES PLUS/ SHUTTEROK

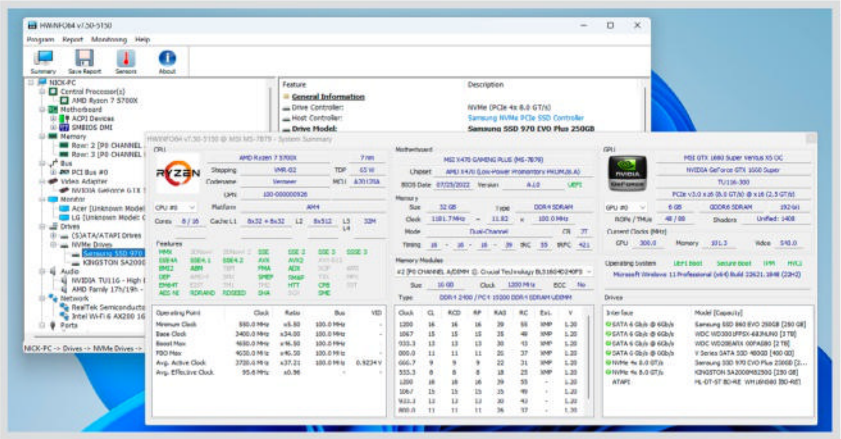
THE FIRST STEP to maintaining your PC is to perform a complete hardware audit. This provides you with a detailed inventory of the various components that make up your PC—including the chipsets that populate your motherboard, allowing you to monitor key aspects of them.

Our current tool of choice is HWiNFO (www.hwinfo.com), which is free for personal use, and can be installed or deployed as a portable app. After setting it up, launch HWiNFO and give it administrator access when prompted. You'll be prompted to start the app, which comprises three main windows: Main, Summary, and Sensors (you can tell HWiNFO which windows to display on startup).

Once your system has been profiled, the Summary screen will display a three-paned window presenting information about your CPU, motherboard, and GPU. This provides quite detailed information about all three components—for example, the CPU pane displays your processor model, its TDP (thermal dynamic power), platform, and supported features, as well as clock information.

The Motherboard section reveals what chipset is powering your motherboard, as well as information about your system RAM: how much, its type, and clock speeds, whether it's running in dual-channel mode, and timings. Beneath this, the Memory Modules section lets you examine the capabilities of each individual stick.

Finally, on the right-hand side, you'll see information about your GPU, including the PCIe bus it's on and its underlying architecture. You'll also see at-a-glance information about your storage, boot setup (including whether it's configured for UEFI and Secure boot, and if a TPM is present), and finally a Windows version and build number.


Get a detailed summary of your system with HwINFO.

TAKE A DEEPER DIVE

This is all useful information, but it merely scratches the surface of what HWiNFO can tell you about your system. Switch to the main window, which works in a similar—but dare we say it, more logical—fashion to Device Manager.

You'll see categories for your CPU, motherboard, memory, bus, video adapter, monitor, drives, audio setup, network, and ports, covering just about every aspect of your PC. While the System Summary provides a pretty detailed overview of your key components, it barely scratches the surface of what you can find out here.

For example, if you expand Motherboard > SMBIOS DMI and select BIOS, you can get details about your motherboard's current BIOS version and TPM version. Turn your attention to the System Slots section, and you can get an overview of what PCI-E and non-storage M.2 slots you have, and what cards or chips are currently populating them.

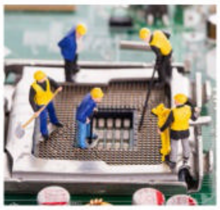
It's worth running through each section to see what kinds of information are available. One particularly useful section is Ports > USB. Here, you'll see a list of all your USB controllers, both those provided by your motherboard and any third-party cards you've plugged in. You'll see each controller's manufacturer and speed at the top level, and by expanding them, followed by Root Hub, you'll see which devices are attached to which controller. This is handy when troubleshooting problems that seem to only affect certain USB devices.

PRODUCE A SYSTEM REPORT

No audit is complete without some kind of report, and HWiNFO has this covered, too. Click the Save Report button to get started. Choose your output format—the default HTML produces a neatly formatted report, but other options—including CSV for a spreadsheet, or a simple summary copied to the Clipboard—are also available. Click Next.

Most options will then display a list of components to include in your report, which you can check or uncheck as required before clicking Finish. If you choose the summary option, you'll get a basic list of info about core components

AUDIT YOUR NETWORK



A key part of your hardware is your network—so when it comes to auditing and maintaining it, you need to cast a wider net than just your main PC. We recommend the open-source NETwork Manager (https://github.com/BornToBeRoot/NETworkManager), which has all the core tools you need.

On first launch, you'll get an overview listing your PC, router, and public IP addresses, along with any DNS information. Below this is Network Interface providing three tabs. Information is self-explanatory, while Bandwidth allows you to monitor downloads and uploads. Configure provides a section for configuring the various network interfaces on your machine.

Beneath this is Wi-Fi, which is useful, as it lists all visible networks and helps you see which channels are congested via its Channels tab. If you want to move your Wi-Fi network to a less congested channel, however, you'll need to manually log into your router to do so.

Below this is a tool for scanning your network to see what devices are currently connected—you'll get their IP address, hostname if one is provided, plus port status (open or closed), and

for copying to the clipboard, before clicking OK.

Whichever format you choose, you'll output a potentially lengthy document listing everything you'd see in the program itself. The default HTML version—which you'd view in your browser—does helpfully provide a clickable Table of Contents list at the top to allow you to jump to the specific parts of your system that interest you.

MONITOR SYSTEM HEALTH

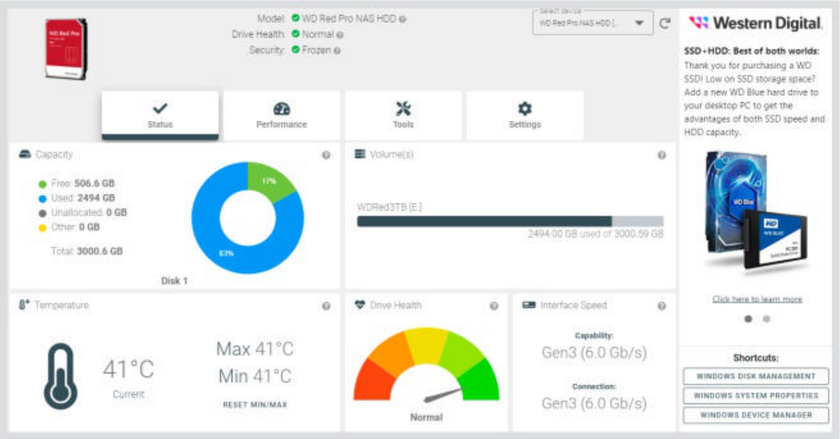
Once you've audited your hardware, you'll want to look at ways of keeping an eye on it going forward—and HWiNFO can help here, too. Specifically, its Sensor window lets you monitor temperatures across your PC—you'll see them fluctuate in real-time, but it also records any maximums, allowing you to spot spikes in temperature that might herald problems, as well as log temperatures over a set period.

Of course, you won't necessarily want to spend your time keeping close tabs on your system, but would probably prefer to be notified should any specific problems be encountered. HWiNFO allows you to set up your own customized alerts, so you get to choose what changes trigger warnings. Click the Settings button on the Sensors window and switch to the Alerts tab, where you can configure alerts for everything shown in the Sensors window, including temperatures and voltages.

It's also possible to set alerts for your drives based on their SMART values, but first you'll need to switch back to the Layout tab to add the required entry—select items from the Hidden Items pane and check 'Show' to bring them into view and make them selectable under Alerts. Items to consider include Drive Remaining Life, Drive Failure, and Drive Warning. You'll see these items appear multiple times—one for each drive—so you'll need to add them all in.

When enabled, alerts can be configured to trigger a variety of events, from playing a sound to displaying a warning window. How you respond to the alert obviously depends on what the trigger is—signs of a drive failing require immediate backup of data and replacement of the drive, while temperature alerts indicate a need to check inside your case. The usual warnings apply—make sure your PC is fully powered off, and earth yourself before opening the case.

Start by ensuring any dust is carefully removed by following the guide on *PC Gamer* (www.pcgamer.com/how-to-clean-your-computer-case). Make sure there's plenty of space between components—tie back cables if necessary


Model: WD Red Pro NAS HDD
Drive Health: Normal
Security: Frozen

Capacity
Free: 506.6 GB
Used: 2494 GB
Unallocated: 0 GB
Other: 0 GB
Total: 3000.6 GB

WDRed3TB [E:]
2494.00 GB used of 3000.59 GB

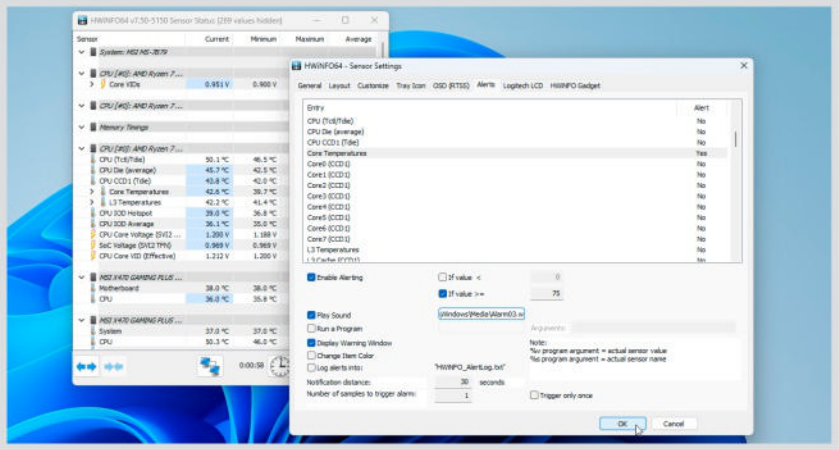
Temperature: 41°C Current, Max 41°C, Min 41°C

Drive Health: Normal

Interface Speed
Capability: Gen3 (6.0 Gb/s)
Connection: Gen3 (6.0 Gb/s)

SSD+HDD: Best of both worlds: Thank you for purchasing a WD SSD! Low on SSD storage space? Add a new WD Blue hard drive to your desktop PC to get the advantages of both SSD speed and HDD capacity.

Each drive manufacturer provides its own tool to manage your drives.


HWiNFO64 - Sensor Settings

Entry	Alert
CPU (Tctl/Tdie)	No
CPU Die (average)	No
CPU CCD1 (Tdie)	No
Core Temperatures	Yes
Core0 (CCD1)	No
Core1 (CCD1)	No
Core2 (CCD1)	No
Core3 (CCD1)	No
Core4 (CCD1)	No
Core5 (CCD1)	No
Core6 (CCD1)	No
Core7 (CCD1)	No
L3 Temperatures	No

☑ Enable Alerting
☐ If value < 0
☑ If value >= 75
☑ Play Sound: \Windows\Media\Alarm03.w
☐ Run a Program
☑ Display Warning Window
☐ Change Item Color
☐ Log alerts into: "HWiNFO_AlertLog.txt"
Notification distance: 30 seconds
Number of samples to trigger alarm: 1
☐ Trigger only once

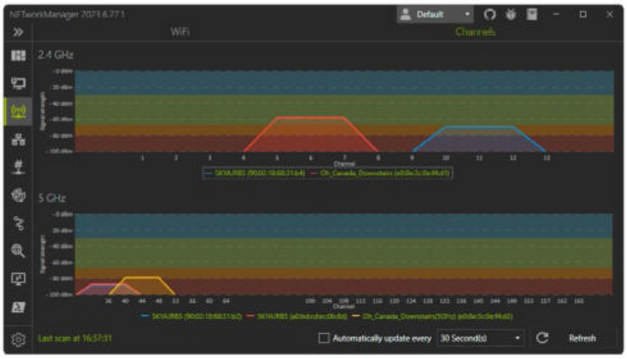
Note:
%v program argument = actual sensor value
%s program argument = actual sensor name

HWiNFO can be configured to alert you based on sensor readings.

whether they're contactable via a simple ping. If any aren't identifiable, switch to the ARP tool, where you'll see a list of IP and MAC addresses. Right-click your device, choose Copy > MAC Address, then switch to the Lookup section and paste in the MAC address to list its manufacturer.

We also recommend you look at Connections, where you'll be able to see precisely what your PC is connected to—both locally and over the internet, and on which ports.

There are too many tools offered by NETwork Manager to list here—you'll probably find it renders many existing networking tools like Putty for ssh connections redundant. Visit https://borntoberoot.net/NETworkManager/Documentation for comprehensive documentation.



NETworkManager is your stop for all things networking.

© WD, HWINFO, NETWORKMANAGER

or re-route them away from your CPU and GPU if possible. Also, check that existing fans are working as they should, and that case fans are configured so cold air is drawn in one end and warm air is pulled out from the other.

It might also be a good time to investigate new cooling methods—is there room in your case for another fan, or do you simply need to explore more effective cooling (particularly if you have plans to overclock your system)?

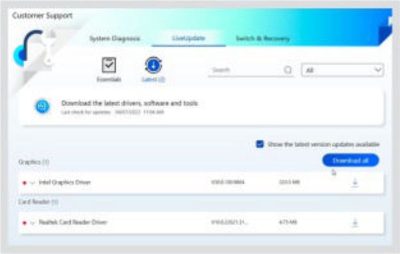
MONITOR KEY COMPONENTS

While HWiNFO provides a good overview of your hardware's health, it pays to explore other available tools that focus on specific parts of your system. Take your hard drives, for instance—all major manufacturers provide dedicated tools for monitoring and tweaking hard drives, particularly SSD and NVMe models.

Identify the manufacturer of your drives, using HWiNFO if necessary, then visit the manufacturer's support pages to find out what utilities are available for monitoring and testing the drive. Examples include Samsung's SSD Magician (https://semiconductor.samsung.com/consumer-storage/magician/), Western Digital's Dashboard (https://support-en.wd.com/app/answers/detailweb/a_id/10346/), and Kingston's SSD Manager (www.kingston.com/en/support/technical/ssdmanager).

These tools provide more than just detailed system health reports about your drives—they're a convenient way to apply firmware updates, run SMART tests (short and long), and give you options for enabling 'over provisioning', which can extend the length of your SSD drives in exchange for giving up around 5-10 percent of drive space.

If you're looking to test your RAM for potential errors that indicate a hardware fault, use Memtest86+ (www.memtest.org). It's based on the original PCMemtest project, but unlike PassMark's variant (Memtest86), is free—and open source. You'll need to create bootable installation media to use it—the simplest solution is to download the ISO file and incorporate it into your Ventoy-powered rescue disk (as featured in the June 2023 issue).



Look for a PC or mobo manufacturer utility to update core drivers.

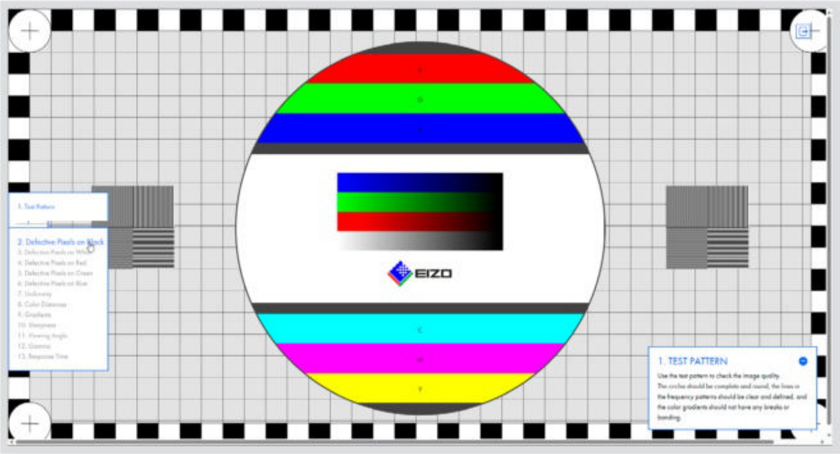
Want to keep tabs on your graphics card? MSI Afterburner (www.msi.com/Landing/afterburner/graphics-cards) is just the tool—not only can you use it to keep tabs on key stats like voltage and temperature, it can display framerates during games (make sure you've checked the 'RivaTuner Statistics Server' during setup), and can also be used to rein things in if your card is being pushed too far through settings to limit power output and temperature. We'll look at it in more detail later.

One often overlooked part of your hardware is the monitor. Given that you can spend hours each day glued to it, it pays to make sure it's configured correctly. Open your browser and navigate to www.eizo.be/monitor-test/ to run the Eizo Monitor Test. This comprises nine different tests designed to make sure your display is both calibrated correctly and isn't suffering from defects like dead pixels. You can run the tests individually or go through them all.

If you run into problems that are the result of miscalibration, consult the monitor manual or visit the manufacturer's website for details on how to correct it using the on-screen display.

KEEP AN EYE ON YOUR BATTERY

If you own a laptop, then your battery is obviously another key component that needs monitoring. You can perform a



Check that your monitor is calibrated correctly by using Eizo's free tests.

© EIZO

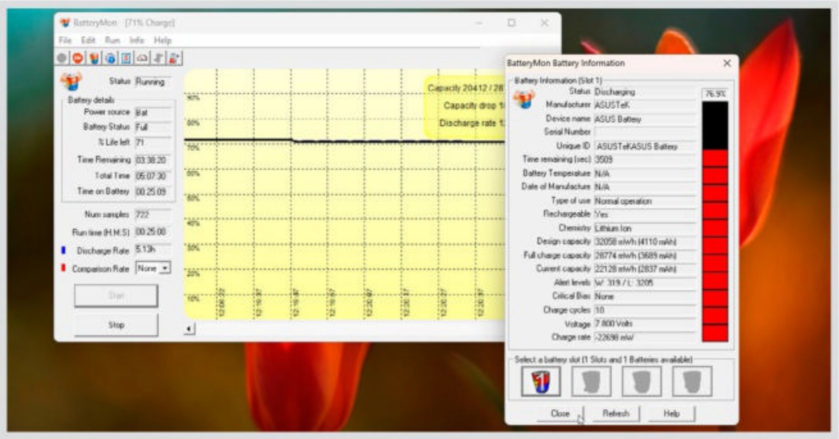
GIVE WINDOWS THE ONCE-OVER

With your hardware checked over, it's time to move on to Windows itself. There are many built-in tools to help look at your operating system, but they're not all grouped together in one convenient place. For this job, we recommend tweaking.com's Windows Repair tool, which makes it easy to run these tests from a single spot.

After installing, reboot your PC into Safe mode—the quickest way to do this is to press Win + R, type msconfig, and press Return. Switch to the Boot tab, check 'Safe boot', and make sure 'Network' is selected before clicking OK and rebooting when prompted.

After you've logged into your user account in Safe mode, launch Windows Repair. We're not actually interested in its repair tools—although do explore them if you've been experiencing certain glitches or problems. Instead, work your way through the four steps, starting with the power reset, which is designed to drain all power (and possible glitches) from your system. Once done, you'll automatically reboot back into Safe mode, so launch Windows Repair again, and skip to step two.

Click 'Open Pre-Scan', followed by 'Start Scan' to



Status Running
Battery details
Power source Bat
Battery Status Full
% Life left 71
Time Remaining 03:38:20
Total Time 05:07:30
Time on Battery 00:25:09
Num samples 722
Run time (H:M:S) 00:25:00
Discharge Rate 5.13h
Comparison Rate None

Battery Information (Slot 1)
Status Discharging
Manufacturer ASUSTeK
Device name ASUS Battery
Serial Number
Unique ID ASUSTeKASUS Battery
Time remaining (sec) 3509
Battery Temperature N/A
Date of Manufacture N/A
Type of use Normal operation
Rechargeable Yes
Chemistry Lithium Ion
Design capacity 32058 mWh (4110 mAh)
Full charge capacity 28774 mWh (3689 mAh)
Current capacity 22128 mWh (2837 mAh)
Alert levels W: 319 / L: 3206
Critical Bias None
Charge cycles 10
Voltage 7.800 Volts
Charge rate -22698 mW

BatteryMon gives you a visual overview of your laptop's battery.

quick and dirty check using the powercfg command-line tool. Right-click the Start button and choose Terminal (Admin), then issue the following command:

```
powercfg /batteryreport
```

Once the report has been generated, open your C drive and double-click battery-report to view a detailed report in your browser. The summary lets you see how far your battery has degraded by comparing its current 'Full Charge Capacity' with its initial 'Design Capacity', but scroll down and you'll see a graph revealing recent usage. Scroll down further to the 'Battery capacity history', which will show you how the battery's capacity has declined over time.

From this, you can extrapolate how much life remains in your battery, or utilize third-party software to do the calculations for you, amid other useful monitoring and optimizing features. One such tool—free for personal use—is BatteryMon (www.passmark.com/products/batmon/). Among its capabilities is a graph projecting the decline of your battery's charge over time—it can also monitor any UPS batteries plugged into your PC.

If you're willing to pay, Smarter Battery ($14 after trial, www.microsys.ro/smarterbattery.htm) provides both monitoring and optimization tools, designed to extend the life of your battery. It also provides a means of analyzing battery performance over time, providing you with projections of its remaining life.

PERFORM A STRESS TEST

One way to check the health of your PC's components is through running a stress test. If you're a heavy duty gamer or dabble in high-end video editing, you'll already be pushing your PC to its limits on a regular basis, but if you're looking to overclock your system or are worried about recent instabilities potentially being linked to failing hardware, a stress test is the way to go to determine if there's an underlying problem that may need correcting (such as easing back on overclocked settings or improving cooling to key components).

Any benchmarking tool will do, but there are dedicated stress-testing tools too: BurnInTest ($129 after free trial, www.passmark.com/products/burnintest/) is one of the most comprehensive out there, and aim firmly at professionals as well as enthusiasts, so you know you'll be well covered. BurnInTest goes way beyond the system's core components to include tests for peripherals such as webcams, USB ports, monitors, printers, and keyboards.

FREE STRESS TESTING

If you're operating on little (or no) budget, then you can still stress-test your core components: CPU, GPU, RAM, and hard drives. One free option is Jam Software's HeavyLoad (www.jam-software.com/heavyload?ca=1), which tests your key components from the CPU and GPU to hard drive and RAM. Portable and installer options are available—launch HeavyLoad and open the Test Options menu to choose which tests to run (CPU and GPU stress tests are enabled by default). Once done, click the play button to run the tests, which will run continuously until your PC falls over or you click the stop button.

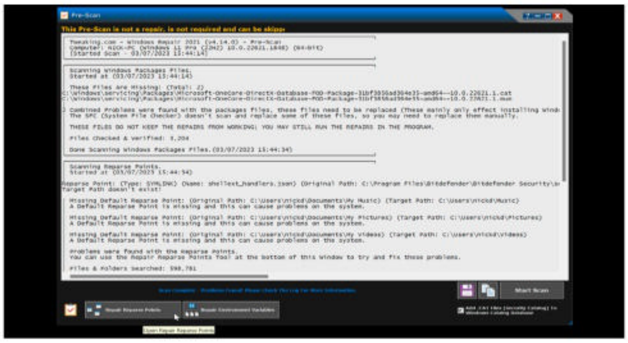
Other tools worth considering for stress tests—particularly when overclocking your CPU and/or RAM—include Prime95 (www.mersenne.org/download/#stresstest). UNIGINE's real-time 3D engine can also be used for a wider stress test that encompasses the GPU, PSU, and cooling systems. It's free, and a variety of models are available, but check your hardware meets the spec before downloading one from its website (https://benchmark.unigine.com/).

When evaluating other tools, proceed with caution—for example, both IntelBurnTest (Intel CPUs, www.techpowerup.com/download/intelburntest/) and FurMark (GPU, https://geeks3d.com/furmark/) are known to push stress testing to extreme levels. You might get a quicker answer to your questions about stability, but only at the risk of potentially damaging your previously functioning components.

perform three scans. If the Windows Package File scan finds any missing files, then make a note of the files and move on—contact the Doctor if you have trouble tracking them down.

After you've performed your pre-scan, perform a disk check of the system drive (run it read-only to avoid a reboot—if any errors are found, then click the button to schedule a reboot for later), and round off your basic checks by allowing System File Checker to run. If it finds any corrupt files, it will fix them.

Once complete, we recommend opening any security tools that you have and running full scans while still in Safe mode before reopening msconfig to the Boot tab, unchecking 'Safe boot' and clicking OK to return to Windows proper.


Pre-Scan
This Pre-Scan is not a repair, is not required and can be skipped
Start Scan

Use Windows Repair to perform key scans of Windows.

© WINDOWS REPAIR, BATTERYMON

Whichever stress-testing tool you go with, it's a good idea where possible to keep a close eye on your components as the tests are being run—have HWiNFO's Sensors window open to monitor system temps, for example.

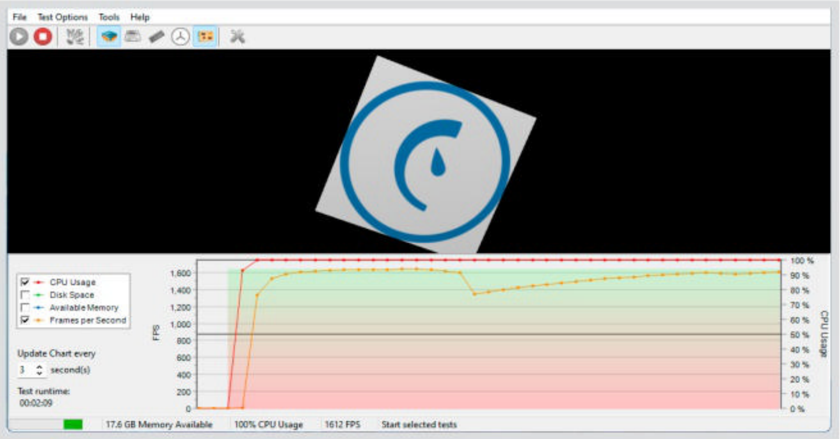
UPDATE HARDWARE

Once you're happy with the condition of your components, make sure the underlying firmware and software is up to date. When it comes to your motherboard's BIOS, you can get its current version (including date) from HWiNFO's Summary window. Head over to the support section of your motherboard's website and look under Support or Downloads to see what the latest version is. There may have been multiple updates since you looked—most updates add support for newer CPUs, but some can plug security holes and fix bugs.

The update procedure varies from motherboard to motherboard—some allow you to search for updates from within the UEFI itself (although be prepared to change server location if you run into an error while downloading an update), but most expect you to download the file to a flash drive and select it manually when you next boot into the UEFI.

Hard drive firmware can be updated via manufacturer drive utilities, while the latest version of drivers can be sourced from a variety of locations. When it comes to your graphics card, installing a tool like NVIDIA's Control Panel gives you access to the latest drivers over and beyond those offered by Windows Update.

Your motherboard manufacturer may offer an all-encompassing driver updater tool, which should at ensure any onboard components like chipset and networking drivers remain updated going forward. Failing that, compare the version number of drivers offered on its website with those shown under Device Manager (right-click the Start button), which you'll find on the item's Driver tab on its Properties dialog.



☑ CPU Usage
☐ Disk Space
☐ Available Memory
☑ Frames per Second

Update Chart every
3 second(s)

Test runtime:
00:02:09

17.6 GB Memory Available | 100% CPU Usage | 1612 FPS | Start selected tests

HeavyLoad allows you to stress-test core components.

If you're struggling to identify certain pieces of hardware in your system—Device Manager is often quite unhelpful in this regard—head to www.tweaking.com to try its Hardware Identify tool. Launch this and click Update to update its database to the latest version before reviewing a complete list of all detected devices. These include 'standard system devices' like the power button or numerous 'PCI standard host CPU bridges'—filter the list by switching to the 'All Except Standard System Devices' tab.

Double-click an entry to reveal more about it—if you don't recognize it, then you'll see a list of possible matches shown, with the most likely match (or matches in the case of CPU models) highlighted in yellow. There's also a link to perform a Google search for the Hardware IDs associated with the entry, in case you're looking for more information online.

Hardware Identifier also identifies hardware devices with no drivers in place or problems—again, switch to the relevant tab to learn more. You may well see one entry marked as 'Unknown' with a Hardware ID of HTREE\ROOT\0—this can be safely ignored.

If you're struggling to track down a specific driver, or feel too lazy to go hunting for drivers from different manufacturers and websites, consider a third-party driver updater tool. Many tend to be bundleware, which is why the safest tool for the job is also the least user-friendly: check out the November 2022 issue for a tutorial on Snappy Driver Installer (www.glenn.delahoy.com/snappy-driver-installer-origin/) to update your drivers, including hard-to-identify ones.

TUNE HARDWARE PERFORMANCE

Once you're happy that your hardware is functioning correctly and has the best possible drivers installed, you may feel that you've done enough. But why settle for maintaining your hardware when you can tune it to boost performance?

The obvious solution is to overclock key components, most notably your CPU, RAM, and graphics. While this can be done from within your motherboard BIOS/UEFI, it's also possible to tune up your PC within Windows itself to save you the hassle of having to shut down and restart.

Before you begin, read the section on benchmarking your PC—this will allow

BENCH-MARK: BEFORE & AFTER

When you come to tune your PC's hardware, you'll want to benchmark it before you make your changes to see what effect your overclocking has on your system. But it's also worth benchmarking your PC as part of your system checkup. In this instance, benchmarking in isolation tells you very little about the state of your computer, so it pays to benchmark every few months to see if performance dips during that period.

It's also good to compare the results of your benchmark with similar setups, so you can see if your PC is performing as it should given its spec. If your PC meets expectations, you can move on to overclocking and repeating the test to see whether you can eke out any noticeable performance gains.

If, on the other hand, your PC falls below expectations, it may indicate an issue that needs addressing. A common cause of sluggish performance is heat—as in too much of it, resulting in thermal throttling as your CPU and other components deliberately slow down to prevent damage. If the temperature readings from HWiNFO appear to support

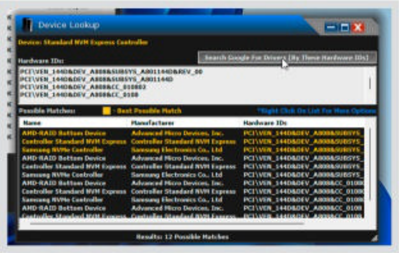
© HEAVYLOAD

you to compare your PC's performance before and after overclocking, allowing you to find a sweet spot between speed and system stability.

Once you have your reference benchmark in place, let's start overclocking your GPU with the previously referenced MSI Afterburner. It uses a separate tool—MSI Kombustor—to stress-test your overclocked settings, which you'll need to download from www.geeks3d.com/furmark/kombustor/d.php. You can run this standalone or access it via the 'K' button in Afterburner.

You can choose from a variety of stress tests, set your screen resolution, and choose what on-screen additions to include (we recommend checking 'Display GPU monitor graph' to monitor GPU temperature). Click 'RUN stress test' and see how the card performs at various levels and what temperature it's running at. You can also benchmark the system.

Press Esc to quit out of this and return to the main Afterburner dialog. From here, there are two ways to overclock your system—the first lets Afterburner determine the best settings for you. To do this, click the OC Scanner button on the left followed by Scan. Once complete, Afterburner will have applied a modest overclock, which you can benchmark and stress-test using Kombustor.


Device Lookup
Search Google For Drivers (By These Hardware IDs)
*Right Click On List For More Options

Device: Standard NVM Express Controller

Hardware IDs:

```
PCI\VEN_144D&DEV_A808&SUBSYS_A801144D&REV_00
PCI\VEN_144D&DEV_A808&SUBSYS_A801144D
PCI\VEN_144D&DEV_A808&CC_010802
PCI\VEN_144D&DEV_A808&CC_0108
```

Possible Matches: ■ - Best Possible Match

Name	Manufacturer	Hardware IDs
AMD-RAID Bottom Device	Advanced Micro Devices, Inc.	PCI\VEN_144D&DEV_A808&SUBSYS_
Controller Standard NVM Express	Controller Standard NVM Express	PCI\VEN_144D&DEV_A808&SUBSYS_
Samsung NVMe Controller	Samsung Electronics Co., Ltd	PCI\VEN_144D&DEV_A808&SUBSYS_
AMD-RAID Bottom Device	Advanced Micro Devices, Inc.	PCI\VEN_144D&DEV_A808&SUBSYS_
Controller Standard NVM Express	Controller Standard NVM Express	PCI\VEN_144D&DEV_A808&SUBSYS_
Samsung NVMe Controller	Samsung Electronics Co., Ltd	PCI\VEN_144D&DEV_A808&SUBSYS_
AMD-RAID Bottom Device	Advanced Micro Devices, Inc.	PCI\VEN_144D&DEV_A808&CC_0108
Controller Standard NVM Express	Controller Standard NVM Express	PCI\VEN_144D&DEV_A808&CC_0108
Samsung NVMe Controller	Samsung Electronics Co., Ltd	PCI\VEN_144D&DEV_A808&CC_0108
AMD-RAID Bottom Device	Advanced Micro Devices, Inc.	PCI\VEN_144D&DEV_A808&CC_0108

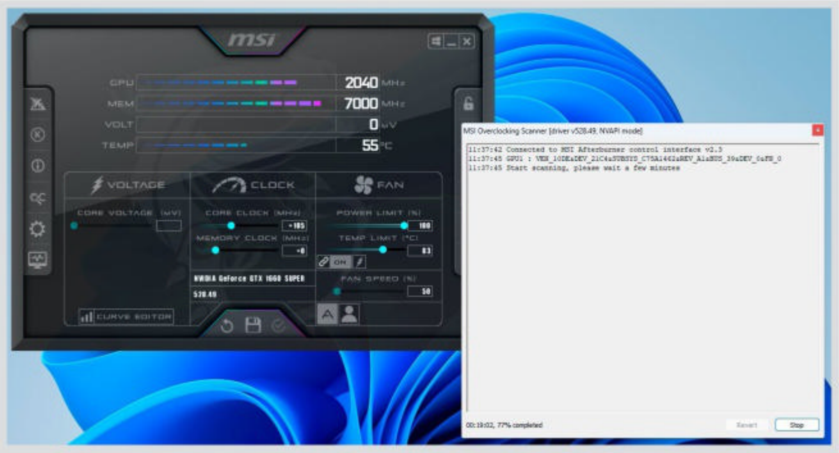
Results: 12 Possible Matches

Hardware Identify might help track down unknown device information.

If you're looking to push things further, then you can use the sliders on the main Afterburner screen. Give yourself more headroom by nudging the Power Limit and Temperature sliders up, then start to play with the Core Clock (MHz) and optionally the Memory Clock too. Move upwards in small increments, and always stress-test your tweaks to get the right balance between stability and performance.

If you're looking to push things further, you'll want to boost your cooling options. Click Settings > Fan tab, check 'Enable user defined software automatic fan control', and create a steep fan curve to bring the fans up to full power to keep GPU temps down (but at the cost of more wear to the fans themselves).

Once you're happy with your overclock, click the floppy button at the bottom of the screen to save it to one of the four available slots on the right. Once saved, click the revert button to go back to normal settings. Going forward, you can invoke the overclock when you need it (for gaming, say) simply by clicking its button followed by Apply.



GPU 2040 MHz
MEM 7000 MHz
VOLT 0 mV
TEMP 55 °C
CORE VOLTAGE (MV)
CORE CLOCK (MHz) +105
MEMORY CLOCK (MHz) +0
POWER LIMIT (%) 100
TEMP LIMIT (°C) 83
FAN SPEED (%) 50
NVIDIA GeForce GTX 1660 SUPER
528.49

MSI Overclocking Scanner [driver v528.49, NVAPI mode]

```
11:37:42 Connected to MSI Afterburner control interface v2.3
11:37:45 GPU1 : VEN_10DE&DEV_21C4&SUBSYS_C75A1462&REV_A1&BUS_39&DEV_0&FN_0
11:37:45 Start scanning, please wait a few minutes
```

00:19:02, 77% completed

MSI Afterburner can automatically configure a modest overclock for you.

OVERCLOCK YOUR CPU

You can overclock your CPU directly from your PC's BIOS/UEFI, but an easier option is to make use of the Windows utilities on offer from your CPU manufacturer, namely the Intel Extreme Tuning Utility (www.intel.com/content/www/us/en/download/17881/) or AMD Ryzen Master (www.amd.com/en/technologies/ryzen-master). Make sure your CPU is supported by checking the compatibility list—more AMD chips are covered than Intel ones.

Intel's XTU comes with built-in benchmarking so you can compare the effects of overclocking on your system, while Ryzen Master offers basic and advanced modes depending on how technical you want to get. Version 2.9 of the latter also introduces a new 'Curve Optimizer Mode' option for the latest 5000-series CPUs and above, which allow you to further tune the overclock.

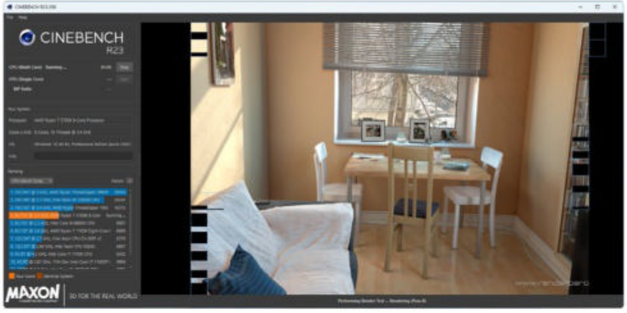
When you switch to Advanced view in Ryzen Master, be sure to click Help for a detailed guide about how to proceed. Two built-in presets—Creator and Game—are supplied, with room for two additional profiles if you want to push the envelope even further. Remember that overclocking is done entirely at your own risk—consider upgrading your cooling if you've not done so already. ⏻

this, open your PC case and make sure it's dust-free and everything is working.

When it comes to benchmark software, there's a range to choose from. PC UserBenchmark (www.userbenchmark.com/Software) lets you compare your system with other users, although there have been controversies about the weighting of its results.

However, for the purposes of comparing like for like, it's a good choice—and free.

Other options include Cinebench (www.maxon.net/en/cinebench), which is also free, but CPU-focused, along with MSI Kombustor for your GPU. Don't forget MSI Afterburner's real-time FPS counter to measure real-world improvements when playing your favorite games.



Check your PC's performance before and after tuning.

© MSI, CINEBENCH, HARDWARE IDENTIFY

magazinesdirect.com

Over 100 brands to choose from

Computer active
STOP USING WINDOWS TOOLS
T3
GADGET OF THE YEAR
GUITAR WORLD
NUNO
APOLLO MISSIONS
HOW NASA TOOK US TO THE MOON
retro GAMER
THE LEGEND OF ZELDA
PC GAMER
DIABLO IV

GIFT IDEA! Gifts that keep on giving

3 GREAT REASONS TO SHOP WITH US

- From tech and gaming titles to fashion and celebrity magazines there's something for everyone.
- Immerse yourself in our specialist one-off publications about your favorite hobby or interest.
- Exclusive Offer - Get 15% Off Guides and Specials - **MDMAG15**

VISIT OUR ONLINE STORE AT www.magazinesdirect.com

✓ Convenient home delivery ✓ Save on shop price ✓ Never miss an issue ✓ 1.4m subscriptions sold

MAXIMUMPC

PREMIUM DIGITAL SUBSCRIPTION

PLUS receive a digital copy of these three special guides, and 100+ back issues

WINDOWS 11 HACKS & TIPS PG.54
BUDGET GPUs REVIEWED PG.74 & 76
THE BEST NVME SSDS PG.12
MAXIMUMPC
TINY BUT MIGHTY
Build a kick-ass Micro PC!
RTX 4060Ti & i5-13600K
Monster living room gaming PC
BUILT & TESTED STEP-BY-STEP GUIDE PG.16
SLAY YOUR RETRO GAMES! PG.32
50 WAYS TO SMASH WORK PG.42
MAXIMUMPC
Linux & Open Source Annual 2023
180 pages of expert tips & tricks
retro GAMER ANNUAL
PC GAMER ANNUAL
TOP 100
DEAD SPACE
DUNE II
DUNGEON MASTERS
HALF-LIFE 2
EXTRA LIFE

PLUS FREE T-SHIRT

ORDER FORM COMPLETE ALL INFORMATION BELOW & RETURN WITH PAYMENT TO: MAXIMUM PC, PO BOX 2029, LANGHORNE, PA 19047-9957

SUBSCRIBE TODAY

☐ **FOR FASTEST SERVICE CALL 1-844-779-2822** AND MENTION CODE **B3DPREM**

☐ **PAYMENT ENCLOSED** (CHECK PAYABLE TO MAXIMUM PC)

☐ **26 PREMIUM DIGITAL ISSUES** FOR $69.99

☐ **13 PREMIUM DIGITAL ISSUES** FOR $36.95

T-SHIRT SIZE

☐ M ☐ L ☐ XL ☐ XXL

BILL TO ADDRESS

NAME (PLEASE PRINT)

ADDRESS

CITY

STATE ZIP

E-MAIL

☐ Check here for news and offers from other Future brands.

*Offer is valid on US orders only, visit us at www.magazinesdirect.com or call 1-844-779-2822 for international pricing and other subscription options. Free gifts are fulfilled once payment is processed. T-shirt design may vary. 13 issues annually. **Offer valid until September 30, 2023.**

Ditch Google FOR DuckDuckGo

DuckDuckGo's new PC browser offers an easy way to stay anonymous online. *Robert Irvine* reveals its best tools, and why you should switch from Chrome and Google search

WHAT YOU CAN DO

- Combine the privacy benefits of Tor with a VPN.
- Block hidden trackers in websites.
- Delete details of your browsing activities with one click.
- Watch YouTube videos without seeing personalized ads.
- Foil spammers and scammers with a Duck email address.
- Import all your bookmarks and passwords from Chrome.
- Prevent apps from tracking you.
- Remove Microsoft's ads from DuckDuckGo search results.

WITH MORE THAN 100 million searches every day, DuckDuckGo's search engine (https://duckduckgo.com) is by far the most popular private alternative to Google and Bing. It has now brought the privacy benefits of its search engine to your desktop by releasing its own browser for Windows PCs.

Available to download from www.duckduckgo.com/windows, the new DuckDuckGo browser comes a year after the Mac version (www.duckduckgo.com/mac), and is still in beta. However, it already looks like a strong competitor to Chrome and Edge, allowing you to browse and search the web without Google and Microsoft spying on you and sharing your data with advertisers.

DuckDuckGo says its browser is designed to "make the internet less creepy and less cluttered" (tinyurl.com/3bs85f9v) by blocking ads, trackers, cookie-consent pop-ups, and other nuisances. It doesn't yet support extensions, but its built-in privacy tools help you stay anonymous online without installing any.

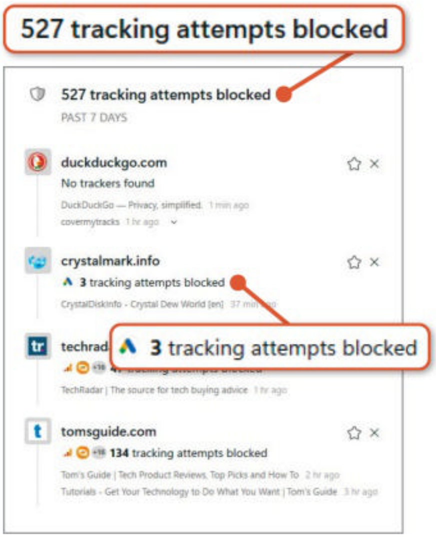
In this feature, we reveal the reasons to switch from Chrome to DuckDuckGo's browser on both your PC and mobile device, and explain why you should ditch Google for DuckDuckGo's search engine. We also see how DuckDuckGo compares with Brave (www.brave.com), which similarly offers privacy-focused browsing and search.

7 REASONS DUCKDUCKGO IS BETTER THAN CHROME

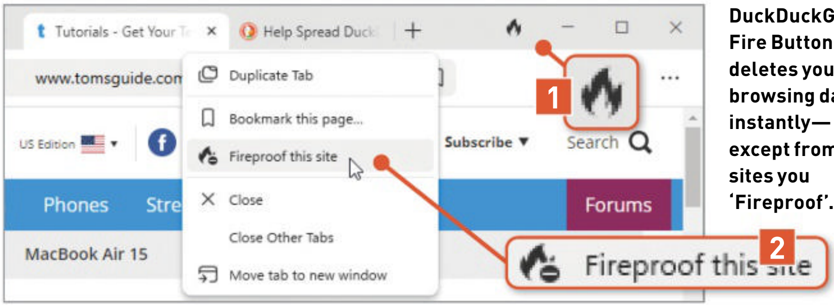
1 Block ads and hidden trackers automatically

The main purpose of DuckDuckGo is to stop you being tracked online, so it's no surprise that its new browser blocks the trackers embedded in websites. However, it goes far beyond the tracking protection offered by Chrome and other browsers by making you as anonymous as possible from the outset.

Most browsers now let you configure their privacy settings to improve their blocking of third-party cookies, fingerprinting, invasive scripts, and other elements that track you, but these can prove confusing and ineffective.


527 tracking attempts blocked
527 tracking attempts blocked
PAST 7 DAYS
duckduckgo.com
No trackers found
DuckDuckGo — Privacy, simplified. 1 min ago
covermytracks 1 hr ago
crystalmark.info
3 tracking attempts blocked
CrystalDiskInfo - Crystal Dew World [en] 37 min ago
techrad
3 tracking attempts blocked
TechRadar | The source for tech buying advice 1 hr ago
tomsguide.com
134 tracking attempts blocked
Tom's Guide | Tech Product Reviews, Top Picks and How To 2 hr ago
Tutorials - Get Your Technology to Do What You Want | Tom's Guide 3 hr ago

DuckDuckGo blocks ads and trackers and reveals how many there are.


Tutorials - Get Your T
Help Spread Duck
www.tomsguide.com
Duplicate Tab
Bookmark this page...
Fireproof this site
Close
Close Other Tabs
Move tab to new window
US Edition
Subscribe
Search
Phones
Stre
Forums
MacBook Air 15
1
2
Fireproof this site

DuckDuckGo's Fire Button deletes your browsing data instantly—except from sites you 'Fireproof'.

In contrast, DuckDuckGo blocks all trackers automatically with no settings to tweak or different 'modes' to apply. The only privacy option you can turn on or off is for Global Privacy Control (GPC)—a new system that asks participating websites not to sell or share your data with other companies.

Particularly impressive is a feature called 3rd-Party Tracker Loading Protection, which prevents hidden trackers from loading in the background before they have the chance to collect information about you. Other browsers merely restrict what these trackers can do once they're loaded, but DuckDuckGo uses a constantly updated list of known trackers to identify and block their requests—Google and Facebook are the worst offenders. See tinyurl.com/5x8vek7y to learn more about this.

Best of all, the browser automatically blocks adverts on web pages to give you a faster and less annoying browsing experience. This saves you needing to install an extension such as uBlock Origin to block ads and trackers (which you can't at the moment, anyway). When you open a new tab, the browser shows you the number of tracking attempts it's blocked and the amount on each site you've visited (see screenshot left).

2 Delete your recent browsing data in one click

One of the most useful privacy tools in DuckDuckGo's browser is its Fire Button, which is the flame icon in the top-right corner (1 in our screenshot above). This lets you close your open tabs and delete your browsing data with one click, including cookies, cached images, file downloads, permissions you've granted, and your browsing history.

The Fire Button is a highly effective way to hide your online activities from people who share or can access your computer, and saves you having to delve into the browser's settings to erase sensitive data manually, like you need to do in Chrome. It also means that you don't need to switch to incognito/private mode when you want to browse the web without the details being stored, because you can cover your tracks later.

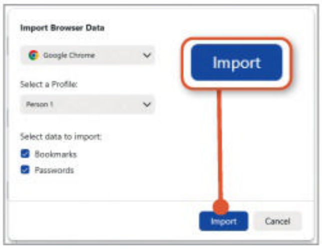
Naturally, you may want to keep your data for certain websites to avoid having to log in again or reconfigure your preferences. You can do so using an option called Fireproofing, which excludes specific sites from the Fire Button's deletions. Simply right-click a tab and choose 'Fireproof this site' 2 to remain signed in and retain your data when you click the Fire Button. Right-click the tab again to remove Fireproofing.

To stop DuckDuckGo reopening tabs when you forget to click the Fire button at the end of a browsing session, click the browser's three-dot button and choose Settings. In the 'On Startup' section, untick the box to 'Restore windows and tabs from previous session'.

Import bookmarks and passwords from Chrome and other browsers

When you first launch the DuckDuckGo browser, it will offer to import your bookmarks and passwords from "less private browsers". Click 'Import' to start this process or—if you skipped it by clicking 'Maybe later'—click the three-dot menu button and choose 'More tools', followed by 'Import Bookmarks and Passwords'.

Select the browser you want to import items from in the dropdown menu—be it Chrome, Firefox, Brave, or Vivaldi, though strangely not Edge.


Import Browser Data
Google Chrome
Select a Profile:
Person 1
Select data to import:
☑ Bookmarks
☑ Passwords
Import
Import
Cancel

DuckDuckGo also lets you import passwords from managers such as Bitwarden, LastPass, and 1Password by exporting them as a CSV file. Choose whether to import Bookmarks, Passwords, or both, select a profile, then click the Import button.

Access your imported bookmarks by clicking DuckDuckGo's menu button and choosing Bookmarks. To view, edit and delete your imported usernames and passwords, and select Autofill to open the password manager.

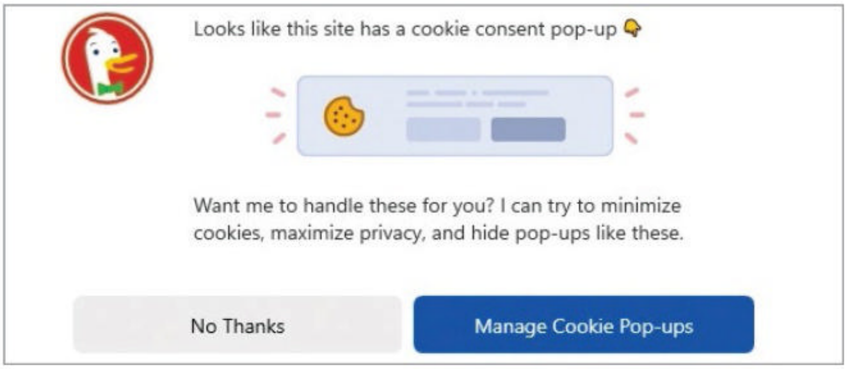
© DUCKDUCKGO

3 Automatically hide cookie-consent pop-ups

As well as blocking ads and trackers, DuckDuckGo's browser hides the irritating cookie-consent banners that obstruct your access to websites. Rather than just dismiss them and allow sites to track you, it automatically selects the most private settings with the fewest cookies, without you needing to click anything.

When you first visit a website that tries to display a cookie-consent pop-up, DuckDuckGo will offer to handle and hide these messages for you. Click 'Manage Cookie Pop-ups' (see screenshot right) to activate the option and block this annoyance. Alternatively, go into the Privacy section of the browser's Settings and tick the 'Let DuckDuckGo manage cookie consent pop-ups' box. Some websites still show cookie banners, but DuckDuckGo says it blocks them on the majority of the major websites online.

Brave also offers this feature, but in Chrome and other browsers you need to install an extension such as 'I don't care about cookies' (tinyurl.com/us9wh3xf).



Looks like this site has a cookie consent pop-up

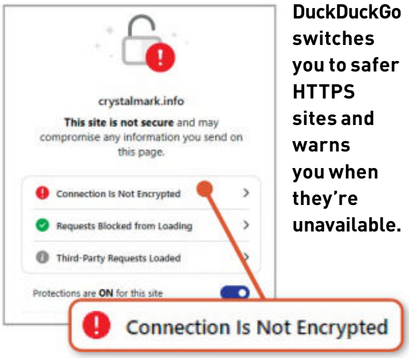
Want me to handle these for you? I can try to minimize cookies, maximize privacy, and hide pop-ups like these.

Avoid seeing cookie-consent pop-ups by getting DuckDuckGo to hide them.

4 Always connect to websites securely

Most browsers now include the option to upgrade websites to their encrypted HTTPS versions to prevent your data from being viewed and stolen by third parties. In Chrome, you need to turn this on manually, but DuckDuckGo enables it by default (as do Brave and Firefox), and doesn't allow you to switch it off.

This means that when you click an HTTP link on a web page, you'll be automatically directed to its secure version. When HTTPS isn't available, you'll see a red dot on the shield icon in the browser's address bar. Click this, and DuckDuckGo will warn you that your connection is not encrypted (see screenshot below), and that any information you enter on the page will be compromised.



crystalmark.info

This site is not secure and may compromise any information you send on this page.

Connection Is Not Encrypted
Requests Blocked from Loading
Third-Party Requests Loaded
Protections are ON for this site
Connection Is Not Encrypted

DuckDuckGo switches you to safer HTTPS sites and warns you when they're unavailable.

5 Search and browse the web anonymously

Although you can change Chrome's default search engine to DuckDuckGo, the browser still shares details of your search terms and the sites you visit with Google. DuckDuckGo's browser is tightly integrated with its search engine, meaning you can't switch to an alternative, but you can search and browse the web anonymously without changing any settings.

It doesn't share information about your searches, collect personal data that can identify you, or tailor your search results to favor pages it thinks you want to see. When you click a result, DuckDuckGo takes you directly to the relevant page without revealing what you searched for to get there, and because it blocks ads and trackers, you won't be followed around the web. See page 55 to learn more about the benefits of DuckDuckGo's search engine.

6 Watch YouTube without ads and tracking

One of our favorite features in DuckDuckGo's browser—which we're certain will never be added to Chrome—is Duck Player. This lets you watch videos on YouTube more privately, without using an extension or an alternative front-end for the site, such as FreeTube (https://freetubeapp.io).

Duck Player works by applying YouTube's strictest privacy settings to prevent the site showing personalized ads and recommendations. Because it blocks the trackers that deliver these, you may not see any ads at all, and the player's distraction-free interface significantly improves your viewing experience.

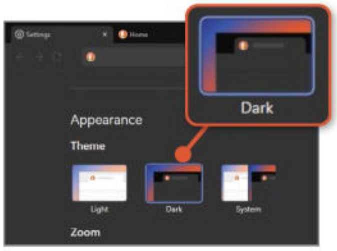
DuckDuckGo stresses that Duck Player isn't completely anonymous because YouTube still logs your views,

Customize how DuckDuckGo's browser looks and works

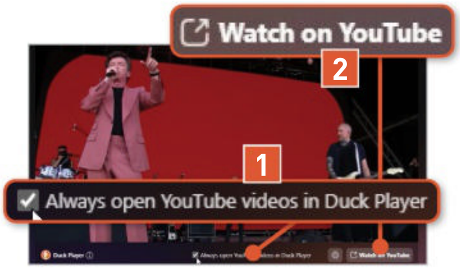
Compared with rival browsers, there currently aren't many ways to customize DuckDuckGo's browser. You can't add new tools by installing extensions, and—unlike Edge, Firefox, and Vivaldi—it doesn't include a bunch of themes for tailoring its appearance to your taste.

You may find this simplicity refreshing, especially when Microsoft and Mozilla keep stuffing their browsers with bloat, and it certainly makes DuckDuckGo easy to use. But if you like tweaking browser settings, there are a few things you can do.

To activate DuckDuckGo's dark mode, click its menu button, select Settings, and find the Appearance section. Choose 'Dark' under Theme (see screenshot) to apply the Dark theme to the browser's toolbars, menus, Home/New Tab page, and the DuckDuckGo search engine. It won't darken the background of other sites. Click the Zoom dropdown menu to increase or decrease the size of web content.



Also on the Settings tab, you can set DuckDuckGo as your default browser (by clicking Make DuckDuckGo Default) and change your default downloads folder.



Duck Player lets you watch YouTube videos without any personalized ads and recommendations.

but the videos you watch won't be used to recommend related content or appear in your YouTube advertising profile.

To start using Duck Player, hover your cursor over the thumbnail of a YouTube video and select Duck Player, or visit a video's page and click 'Watch in Duck Player'. This will open in the video in a clutter-free overlay with a dark background, which makes it easier to focus on the content. Tick the 'Always open YouTube videos in Duck Player' box (1 in our screenshot above) to set it as your default option. Switch back to viewing videos on YouTube by clicking 'Watch on YouTube' 2, or disable the feature by choosing 'Never use Duck Player' in the browser's settings.

7 Avoid spam by disguising your email address

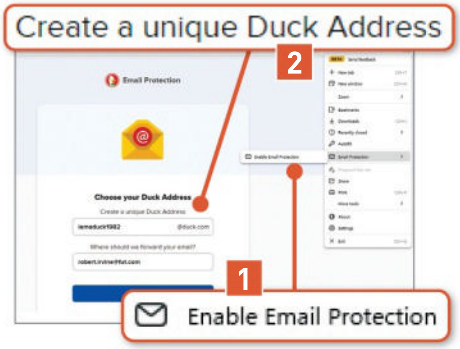
DuckDuckGo's email-forwarding service, Email Protection, is one of the best features in its mobile app and browser extension, so we're delighted that it's now also available in the desktop browser.

Email Protection gives you a free '@.duck.com' Duck address you can use to sign up with websites to prevent your real address from falling into the hands of spammers and scammers. The service then forwards messages to your usual inbox after removing all the hidden trackers, so you won't be targeted with personalized ads. You can reply to these emails from your Duck address instead of your genuine one.

To use Email Protection in the browser, click the three-dot menu button, choose Email Protection, then Enable Email Protection (1 in our screenshot right). Click 'Get Started' on the page that opens, then Next, and specify the Duck address you want to use 2. Enter the email address to forward messages to, click Continue, and choose 'This is correct'.

Verify your email, and you'll be able to use your Duck address to register with websites—simply click the DuckDuckGo logo in the email field.

You can create further '@.duck.com' addresses, if your main one starts to receive junk mail, by choosing Generate Private Duck Address. Visit www.duckduckgo.com/email in the DuckDuckGo browser to manage your Email Protection account and addresses.

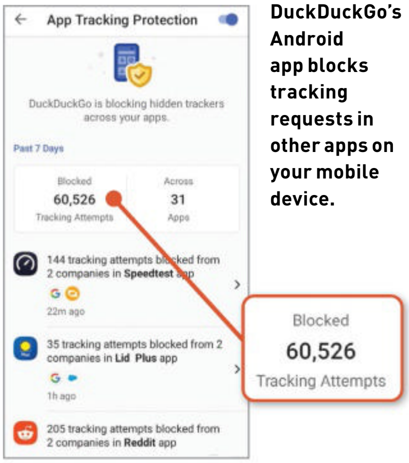


Email Protection offers an email address for signing up to websites and receiving spam.

INSTALL DUCKDUCKGO'S MOBILE APP & EXTENSIONS

DUCKDUCKGO's Private Browser app for Android (tinyurl.com/5687vvb5) and iOS (tinyurl.com/ykzfvbej) offers many of the same features as the new Windows browser, including tracker-blocking, cookie-pop-up management, the Fire Button, and Email Protection.

The Android version also includes a powerful privacy feature called App Tracking Protection. As well as blocking hidden trackers in sites you visit in DuckDuckGo Private Browser, it blocks tracking requests in other apps installed on your phone or tablet. This prevents them from collecting data about you while still allowing necessary permissions.



DuckDuckGo is blocking hidden trackers across your apps.

144 tracking attempts blocked from 2 companies in Speedtest app

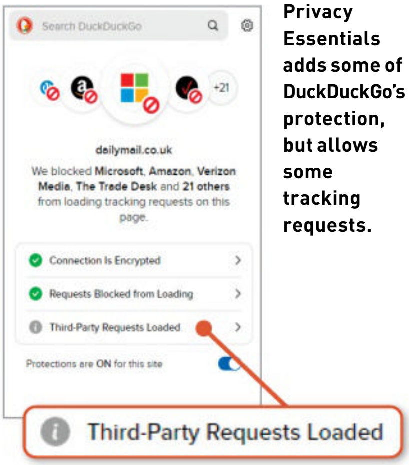
35 tracking attempts blocked from 2 companies in Lidl Plus app

205 tracking attempts blocked from 2 companies in Reddit app

DuckDuckGo's Android app blocks tracking requests in other apps on your mobile device.

To activate the feature, tap the browser's three-dot menu, select Settings, and enable App Tracking Protection. Tap 'OK' to allow DuckDuckGo to set up a VPN on your device—this isn't a real VPN, but allows it to block trackers at a network level.

The browser will tell you how many tracking attempts it has blocked in apps in the past seven days (see screenshot below left) and the tracking companies responsible. App Tracking Protection is still in beta, but if you experience any problems, you can disable its protection for all or specific apps using the slider in the top-right corner.


Search DuckDuckGo
+21
dailymail.co.uk
Connection Is Encrypted
Requests Blocked from Loading
Third-Party Requests Loaded
Protections are ON for this site
Third-Party Requests Loaded

We blocked Microsoft, Amazon, Verizon Media, The Trade Desk and 21 others from loading tracking requests on this page.

Privacy Essentials adds some of DuckDuckGo's protection, but allows some tracking requests.

Unlike DuckDuckGo's desktop browser, the mobile app lets you switch off autocomplete in its address bar to stop it suggesting sites from your Bookmarks when you start typing a search query or URL. In the Android or iOS app, open Settings, and disable the Autocomplete Suggestions option.

DuckDuckGo's Privacy Essentials extension for Chromium browsers (tinyurl.com/3bu4zhfc) and Firefox (tinyurl.com/mr3dbh45) offers several features found in the new browser. These include blocking tracking scripts, third-party cookies, and fingerprinting; hiding your email address using Email Protection, and forcing sites to use secure HTTPS encryption.

It's a good way to get some of DuckDuckGo's privacy benefits in your current browser, but you may not like that it changes your default search engine and homepage to DuckDuckGo.

The add-on also allows some tracking requests (see screenshot left) "to prevent site breakage", while the DuckDuckGo browser does a better job of identifying and blocking non-essential elements.

© DUCKDUCKGO

GET READY TO BECOME A TRUE PYTHON EXPERT

Make Python work for you with tutorials on coding with Django, Flask, Pygame and even more useful third-party frameworks.

NEW
Everything you need to start coding with Python in Linux
The Python Book
Over 400 essential tips
ON SALE NOW
OVER 2 HOURS OF VIDEO TUTORIALS
Learn to use Python • Program games • Get creative with Pi
The Python Book Fourteenth Edition
100% UNOFFICIAL
ISBN 978-1-80308-208-0
FUTURE
FOURTEENTH EDITION

FUTURE

Ordering is easy. Go online at:

magazinesdirect.com

Or get it from selected supermarkets & newsagents

DITCH GOOGLE SEARCH FOR DUCKDUCKGO

DUCKDUCKGO has a well-deserved reputation as the best private alternative to Google's search engine, but it has many other advantages besides letting you browse the web anonymously. Here, we reveal our favorite tricks for making the most of DuckDuckGo's search engine, whether you're using its new browser or another one.

Search specific websites using 'bangs'

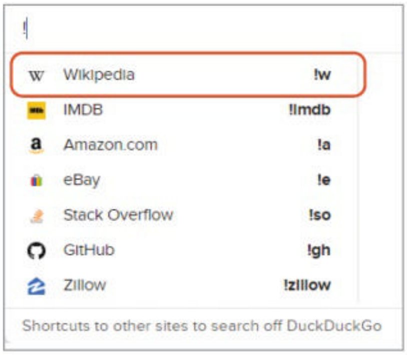
DuckDuckGo has a unique search feature called Bangs, which lets you search within specific sites directly from its search engine. Bangs are shortcuts you type before your search queries, which consist of an exclamation mark followed by a site's first letter, an abbreviation of its name, or a keyword.

Examples of bangs include !auk to search Amazon.co.uk, !w for Wikipedia (see screenshot below), !r for Reddit, !nf for Netflix, and !yt for YouTube. The results open in the corresponding website rather than DuckDuckGo, which means they aren't anonymous, and your data may be tracked, so it's more of a time-saving tip than a privacy one. However, if you're using DuckDuckGo's browser or extension, it will block most hidden trackers, so you don't need to worry.

There are now more than 13,500 DuckDuckGo bangs to try across categories including News, Entertainment, Shopping, and Online Services. Visit www.duckduckgo.com/bangs to browse the full range.

Apply 'infinite scroll' to your search results

Last December, Google added 'Continuous Scrolling' to its search engine, which loads the next page of search results automatically when you reach the bottom of a page. Annoyingly, the feature is still only available to Google users in the US, but DuckDuckGo has offered it to everyone for years.



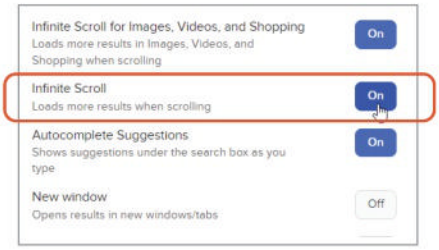
!

Wikipedia	!w
IMDB	!imdb
Amazon.com	!a
eBay	!e
Stack Overflow	!so
GitHub	!gh
Zillow	!zillow

Shortcuts to other sites to search off DuckDuckGo

© DUCKDUCKGO

Save time by using DuckDuckGo's 'bangs' to search specific websites.



Infinite Scroll for Images, Videos, and Shopping — On
Loads more results in Images, Videos, and Shopping when scrolling

Infinite Scroll — On
Loads more results when scrolling

Autocomplete Suggestions — On
Shows suggestions under the search box as you type

New window — Off
Opens results in new windows/tabs

Turn on Infinite Scroll to load the next page of search results automatically.

To enable the option, click the menu button in the top-right corner and select All Settings, then switch on Infinite Scroll (see screenshot above), and click 'Save and Exit'. You can then keep scrolling through your search results without needing to click to load the next page. As with Google's Continuous Scrolling, only the first six pages of results are loaded to keep your browser's memory usage under control.

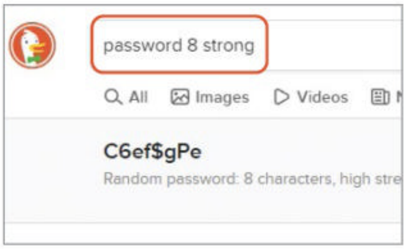
DuckDuckGo also offers Infinite Scroll for image, video, and shopping results—this option is enabled by default.

Generate strong passwords using DuckDuckGo

When you register with websites in DuckDuckGo's new browser, its Autofill password manager will suggest a strong password to use—click the password box to view and save the suggestion.

DuckDuckGo's search engine can also generate random passwords for your online accounts. Simply type password 8 in the search box, press Enter, and DuckDuckGo will create a password consisting of eight characters and display it below the search box. Typing password 16 will produce a 16-character login.

To generate a stronger password that includes special characters such as punctuation marks, enter password 8 strong (see screenshot below). Additionally, DuckDuckGo can create passphrases—type a random passphrase for a four-word example, such as 'cassette impound sandbag variable'.

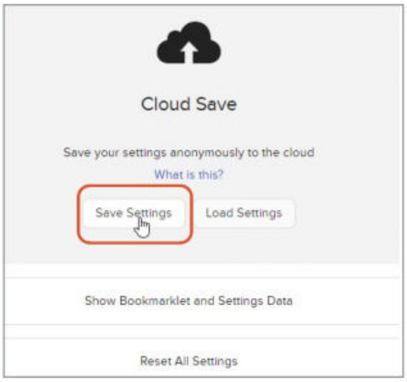


password 8 strong

C6ef$gPe

Random password: 8 characters, high stre

Use DuckDuckGo to create secure passwords for signing up with websites.



Cloud Save

Save your settings anonymously to the cloud

Save your DuckDuckGo search settings to access them on another device.

Sync your DuckDuckGo settings across devices

DuckDuckGo's PC browser and mobile app don't let you sync your bookmarks, passwords, and other data across devices, though the company says it's working on the option. However, you can share your settings for its search engine between your PC and phone or tablet. A feature called Cloud Save lets you store your settings online, so you can load them on another device without needing to reconfigure DuckDuckGo.

To use Cloud Save, open All Settings and click Save Settings (see screenshot above) under Cloud Save. Enter a passphrase to encrypt and protect your settings, then click Save.

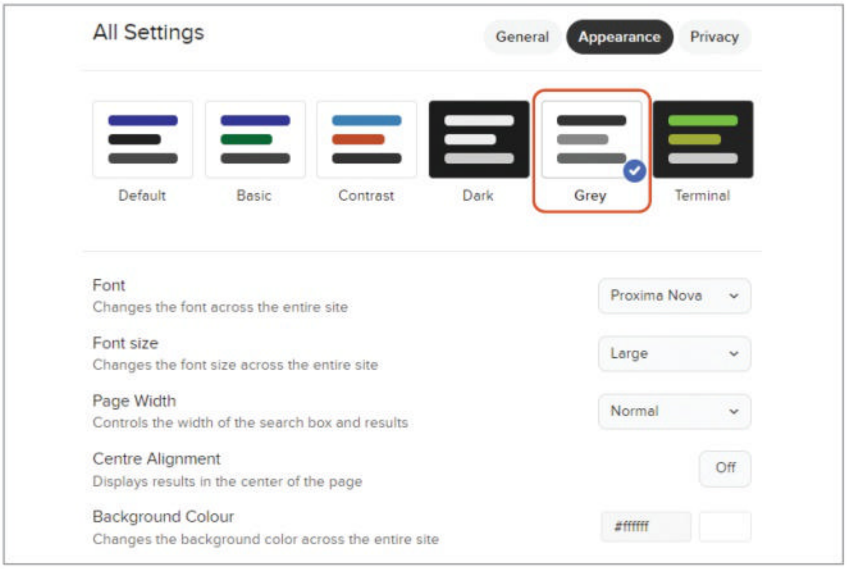
To apply these settings on another device, open DuckDuckGo, select All Settings, and click Load Settings. Enter your passphrase and click Load.

Customize DuckDuckGo's appearance

Although you can't really customize the DuckDuckGo browser—other than switching it to dark mode—it is possible to change the appearance of the search engine. This won't make it any more private, but it can make the site easier on your eyes. It's also more than Google lets you do, where your only options are Dark or Light themes.

Open 'All Settings' and click the Appearance tab at the top of the page. Select one of the five themes, which include Grey, Contrast (makes text easier to read), and Terminal (a colourful dark theme), to apply it to the search engine, then click 'Save and Exit'.

You can also adjust specific aspects of the site's design, including the font, page layout, link color, and whether favicons appear next to results.



Font
Changes the font across the entire site
Proxima Nova

Font size
Changes the font size across the entire site
Large

Page Width
Controls the width of the search box and results
Normal

Centre Alignment
Displays results in the center of the page
Off

Background Colour
Changes the background color across the entire site
#ffffff

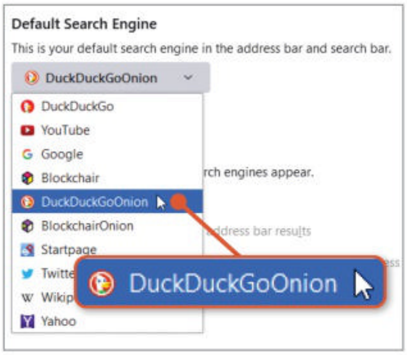
Customize the appearance of DuckDuckGo's search engine to suit your taste.

Use DuckDuckGo's 'onion' site in Tor Browser

By blocking trackers and targeted advertising, and never collecting or sharing your data, DuckDuckGo is a much more private way to search the web than Google. However, even when used in the new DuckDuckGo browser, it won't keep you completely anonymous, because it doesn't hide your IP address from the sites you visit.

For that, you either need a VPN or to use DuckDuckGo in the privacy-focused Tor Browser (tinyurl.com/bd6a8tkh). Unsurprisingly, DuckDuckGo is that browser's default search engine, and it also has a special onion website. This applies end-to-end encryption to your search queries in Tor, so nobody can see what you're looking for, or where from. Don't worry—it won't find dubious dark web sites, only standard 'clear web' ones.

To access the onion version of DuckDuckGo, enter its 56-character URL into Tor Browser—or type tinyurl.com/24m784e3 to save time (click 'Continue to site' if you see a warning). Alternatively, select the DuckDuckGoOnion option below the address bar when typing a search query.



Default Search Engine
This is your default search engine in the address bar and search bar.
DuckDuckGoOnion

Use DuckDuckGo's onion version to make searches completely anonymous.

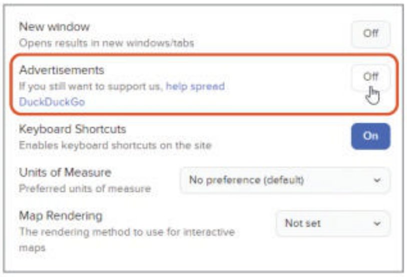
To always use the onion site, click Tor Browser's three-line menu, choose Settings, then Search and select DuckDuckGoOnion as the Default Search Engine (see screenshot left). Because of the roundabout way in which Tor works, DuckDuckGoOnion is slower than the standard version, which is probably why the latter is the browser's default option.

Remove ads from DuckDuckGo's search results

Like Google, DuckDuckGo is funded by advertising, but it doesn't gather your search data to build a profile of your interests and use that to target you. Instead, it uses keywords to decide the type of ads you see in your search results.

For example, if you search for 'Samsung smart TV', DuckDuckGo will show you adverts for that make of television at the top of your results—even in the otherwise ad-free DuckDuckGo browser. These are clearly marked as Ads, and there are fewer than on Google.

If you'd prefer not to see any ads, click DuckDuckGo's menu button, choose All Settings, and switch off the Advertisements option (see screenshot below), then click 'Save and Exit'.



New window
Opens results in new windows/tabs
Off

Advertisements
If you still want to support us, help spread DuckDuckGo
Off

Keyboard Shortcuts
Enables keyboard shortcuts on the site
On

Units of Measure
Preferred units of measure
No preference (default)

Map Rendering
The rendering method to use for interactive maps
Not set

Disable the Advertisements option to remove ads from DuckDuckGo's results.

Does Microsoft compromise DuckDuckGo's privacy?

Last year, DuckDuckGo caused concern when it was reported that it was allowing Microsoft trackers in its mobile apps and browser (which was Mac-only at the time). The search engine sources most of its results from Microsoft's Bing, so the news suggested that DuckDuckGo was compromising its privacy—and that of its users—for the benefit of its commercial partner.

In response, DuckDuckGo updated the agreement regarding its use of Bing search results, and will now "block Microsoft scripts from loading on third-party websites" in its browser and extensions. It has also vowed to be more transparent about its partnership with Microsoft.

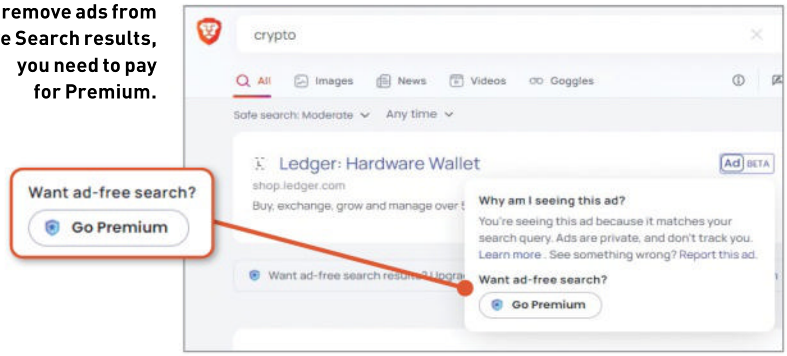
In a Help Pages article entitled 'Ads by Microsoft on DuckDuckGo Private Search' (tinyurl.com/6j9pm2hk), the company clarifies that while it doesn't collect or share your search data, if you click an ad in its search results, "you will be redirected to the advertiser's landing page through Microsoft Advertising's platform". This means that you will lose some of the privacy DuckDuckGo gives you, though it stresses that "Microsoft Advertising does not associate your ad-click behavior with a user profile".

To be on the safe side, you can disable ads in search results, as described above.

INSTALL DUCKDUCKGO'S MOBILE APP & EXTENSIONS

DUCKDUCKGO's Private Browser app for Android (tinyurl.com/5687vvb5) and iOS (tinyurl.com/ykzfvbej) offers many of the same features as the new Windows browser, including tracker-blocking, cookie-pop-up management, the Fire Button, and Email Protection.

We often recommend Brave as the best private browser, but with DuckDuckGo flying into view, there's a new contender for Brave's crown. Here, we examine how the two browsers and their respective search engines compare.



Why am I seeing this ad?

You're seeing this ad because it matches your search query. Ads are private, and don't track you. Learn more . See something wrong? Report this ad.

To remove ads from Brave Search results, you need to pay for Premium.

Browser features and performance

Brave is a Chromium-based browser, but disables nearly all the Google features built into that code "for privacy/security reasons" (see tinyurl.com/52vkbwhd). Its powerful Shields system blocks ads and trackers, invasive cookies, potentially dangerous scripts, and fingerprinting.

Other options include automatically upgrading websites to HTTPS (Brave was the first browser to offer this), protection against malware and phishing, and a private mode that lets you access sites anonymously through the Tor network. You can add further tools by installing extensions from the Chrome Web Store, but it already has your privacy covered.

DuckDuckGo uses a streamlined version of Edge's Chromium code called WebView2. As we've explained, this makes its interface very simple, with few settings to configure and privacy protection that works automatically in the background, plus the option to delete browsing data with a click. This is markedly different to Brave's long lists of settings, which you can tweak to achieve your desired privacy level and enhance with additional content-blocking filters. It's likely that DuckDuckGo will add more options in future versions, but currently it can't compare to Brave's configurability.

On the plus side, DuckDuckGo doesn't suffer from Brave's bloat, such as its cryptocurrency wallet, paid-for VPN, and video-conferencing tool. However, it does have useful features, such as Email Protection and the Duck Player.

When we tested the speed of both browsers using the online benchmarking tool Speedometer 2.0 (tinyurl.com/myde6juh), Brave achieved a score of 119 runs per minute (runs reflect how quickly a browser can render web content), while DuckDuckGo lagged slightly behind with 110. That's a respectable result considering it's still in beta, and faster than Chrome, which scored only 99.5.

DuckDuckGo did beat Brave for lower resource usage—with the same tabs open in both browsers, it used only 164MB of RAM compared to Brave's 239MB (see screenshot below left). Again, Chrome fared worse with a whopping 1312MB.

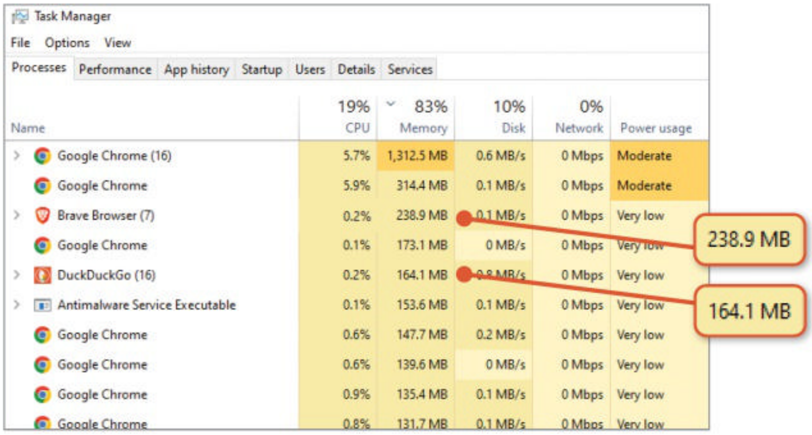
Search engines and adverts

While DuckDuckGo has evolved from a search engine to a browser, Brave has taken the opposite trajectory. It launched Brave Search (https://search.brave.com) two years ago, and describes the search engine as "the real alternative to Google", though initially it incorporated results from Google and Bing—and still does for image and video searches.

Since April this year, Brave Search has relied solely on its own independent search index, and its website even takes a swipe at DuckDuckGo for using Bing. It also criticizes DuckDuckGo for not being "integrated with a private browser"—a point that now needs correcting!

Like DuckDuckGo, Brave Search lets you search the web without being tracked, and doesn't filter your results using secret algorithms. It finds relevant pages impressively quickly, though its presentation could be improved, with only brief descriptions of each result.

Adverts occasionally appear above your results, and in the Brave browser's new tab page and news feed. Brave says these are "privacy-preserving ads". To remove them you must pay $3 (£2.40) a month for Search Premium (see screenshot above). In contrast, DuckDuckGo lets you disable ads for free (see opposite page). It also searches more sites than Brave, provides full descriptions of results, and helpfully suggests related searches.



Name	19% CPU	83% Memory	10% Disk	0% Network	Power usage
Google Chrome (16)	5.7%	1,312.5 MB	0.6 MB/s	0 Mbps	Moderate
Google Chrome	5.9%	314.4 MB	0.1 MB/s	0 Mbps	Moderate
Brave Browser (7)	0.2%	238.9 MB	0.1 MB/s	0 Mbps	Very low
Google Chrome	0.1%	173.1 MB	0 MB/s	0 Mbps	Very low
DuckDuckGo (16)	0.2%	164.1 MB	0.8 MB/s	0 Mbps	Very low
Antimalware Service Executable	0.1%	153.6 MB	0.1 MB/s	0 Mbps	Very low
Google Chrome	0.6%	147.7 MB	0.2 MB/s	0 Mbps	Very low
Google Chrome	0.6%	139.6 MB	0 MB/s	0 Mbps	Very low
Google Chrome	0.9%	135.4 MB	0.1 MB/s	0 Mbps	Very low
Google Chrome	0.8%	131.7 MB	0.1 MB/s	0 Mbps	Very low

DuckDuckGo uses less system memory than Brave, though is slightly slower.

© DUCKDUCKGO

Our verdict

It's slightly unfair to compare DuckDuckGo with Brave when it has only just launched its browser, but they're now the closest competitors for your online privacy needs. Brave offers greater scope for configuring your settings and loads pages faster, but DuckDuckGo is simpler, uses less memory, and lets you hide search ads without paying. There's certainly no harm in installing both browsers to decide which is best for you.

Skytech Chronos 2

WE'VE BEEN LOOKING to get our hands on a Skytech PC ever since the Ontario-based system builders rocked up on the scene with supremely affordable pre-built gaming PCs. These machines seemed to be absolutely acing the expected gaming PC spec for the price.

At around $1,500, this Skytech Chronos 2 config comes in right where we'd like to see a RTX 4070 gaming PC. The fact that there are still RTX 3080-powered gaming PCs with price tags almost as high just underlines the value on offer here.

Anyway, while the last-gen AMD Ryzen 5 5600X in the Chronos 2 is a couple of years old, it still manages to shine today when it comes to gaming. Likewise, Skytech could have slapped an AIO cooler on the CPU, but we found that the chip runs pretty cool on air. So why push up the price? The same probably applies to the 1TB MSI Spatium M371 SSD. Sure, it's an older Gen 3 drive, but are you going to feel the difference?

The main star of the show here is, of course, the RTX 4070. In the Skytech Chronos 2, the small but mighty 12GB Zotac Twin Edge take on the 4070 packs the same 2,475 MHz boost clock speeds as the Founders Edition card. There's hardly a game it can't handle at 1440p, and it'll run a lot of games reasonably well at 4K, especially if you enable DLSS scaling.

As for looks, well, the Chronos 2 Black case is pretty slick given the price point. There's also just enough programmable RGB lighting, including a trio of 120mm fans on the front and the CPU cooler, to keep most modders busy.

–JEREMY LAIRD

ZOTAC GAMING
RTX
HELIOS P16

1 READY TO ROLL

The Skytech Chronos 2 is perfect if you want to get some quick and dirty gaming done. Fully ready to go from the factory, with basic peripherals including a mouse and keyboard in the bundle, this one is a no-fuss setup. That said, it may not be long before you're itching to upgrade some of the weaker components.

2 4070 FTW

No question, this PC is all about that RTX 4070 GPU. It's a killer 1440p card for straight-up raster rendering, and thanks to Nvidia's advanced graphics architecture, it's faster than the AMD alternative for ray tracing, too. What's more, enabling Nvidia's awesome DLSS scaling tech means that 4K isn't out of the question, either.

3 STAY COOL

Both the CPU and GPU in the Skytech Chronos 2 run below 70 degrees Celsius, even under sustained heavy load. That bodes well for long-term reliability and it just goes to show that you don't need a fancy water cooling setup. Still, there's plenty of space inside the custom Chronos case to add additional cooling down the line.

SAVE YOUR OLD PC!

Give your hardware some extra longevity. *Jonni Bidwell* shows you how Windows fails and Linux Mint prevails

SPRING IS UPON US northern hemisphere dwellers once again. Many look to the season of rejuvenation as a time for investing in new hardware. That dusty Windows 7 PC might be destined for landfill, or perhaps your Windows 10 machine is struggling. Slow PCs are a nightmare to use, and we understand the temptation of out with the old, and in with the new.

If 'the new' is a new Windows machine, we urge caution. Many of us can't afford shiny new computers. But with a little hardware refresh and the power of open source software, old machines can be granted a new lease of life.Linux Mint is easy to install, simple to use, and doesn't spy on you. With a couple of sticks of memory and a solid-state drive (SSD), we'll show you how it can make your old machine fly (not into a dumpster).

© MAGICTORCH

OLD HARDWARE VS NEW SOFTWARE

Microsoft would love you to buy a new Windows 11 PC, but your old hardware can find a new lease of life

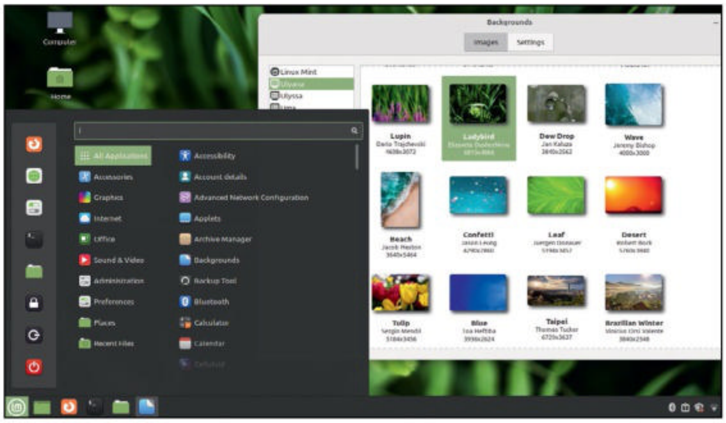
WHEN WINDOWS 10 was released, Microsoft quite clearly said that this would be the final version of the OS. This turned out to be a poor marketing strategy, and soon rumors of Windows 11 began to circulate. The software was eventually released at the end of 2021, and many Windows 10 users now live in fear of a phantom forced update to the new release by night.

Windows 10's hardware requirements were quite low, largely on account of Microsoft understandably wanting to get as much of its userbase on to the same version. If you want to install Windows 11, though, it's a different story. We can forgive the 4GB of RAM and dual-core, 64-bit processor stipulations—that's in line with what you'd want to run a modern desktop environment on Linux. We can also forgive 64GB of storage, but only because storage is cheap these days. What draws our ire is the need for UEFI Secure Boot and, in particular, a Trusted Platform Module (TPM) 2.0 chip. UEFI has been around for a decade (though not everyone likes it), but compatible TPM chips have only gone mainstream over the last five years.

Farewell to Windows

It is possible, via editing of ugly registry keys during installation, to bypass any or all of these requirements. But this isn't something your average user is going to know how to do. Nor might they want to—such a configuration is unsupported by Microsoft, and it claims "is not entitled to receive updates". Anecdotal evidence suggests such installs have in fact received security updates, but it's not at all given that this will continue. The upshot is there's a whole host of very capable hardware stuck running Windows 10, and when that goes EOL in 2025, that hardware will have to exit the Microsoft ecosystem, one way or another.

We've long touted Linux's ability to run on older hardware, so naturally we implore anyone feeling disgruntled about not qualifying for Windows 11 to give it a whirl. Anything that ran Windows 10 can run Linux Mint without a care. Things are not so simple once we start looking at hardware from previous epochs, though. Up until around 2004, most x86 PCs had 32-bit processors, which is to say that at the lowest levels, they operated on binary 'words' 32 bits long. These words were not long enough, so the x86_64 architecture was born, and by 2006, very few 32-bit x86 CPUs were being produced. Windows 10 still supports 32-bit machines, as do many versions of Linux (Debian, Gentoo, PCLinuxOS). However, many popular Linux distros, in particular Ubuntu, Fedora, and Arch, do not. We're going to look at Linux Mint over the page, our go-to distribution for beginners and those fleeing Windows. Mint's main release is based on Ubuntu, but it has a lesser-known Debian-based release that works in much the same way. This is what we recommend for your 32-bit boxes.



Don't judge a book by its cover, but by all means judge Linux Mint by its incredible background selection.

VERY OLD HARDWARE

It's well documented that Linux came into being by way of Linus Torvalds's 386 PC in 1991. In the beginning, this was the only hardware that the OS supported. Soon, it was rewritten in portable code and ports to the Motorola 68000 IBM s/series, and other platforms duly appeared. It might have been a sad day, then, when in 2012, 386 support was dropped from the kernel. Linus didn't seem to think so, though, as he bid it and its ugly memory management good riddance. So no, you can't run (modern) Linux on a 386 today.

The kernel supports 486s and early Pentiums, but you'd run into trouble running most distros on them. Distros that still provide 32-bit builds might still require CPU support for physical address extension (PAE), which is only present on Pentium Pro and later hardware, dating back to 1995. PAE allows more than 4GB of RAM to be addressed, although each program is limited to 4GB. This is where the misconception that 32-bit systems can't use more than 4GB comes from. You can disable PAE at the boot menu (and distros such as Bodhi's Legacy edition disable it by default).

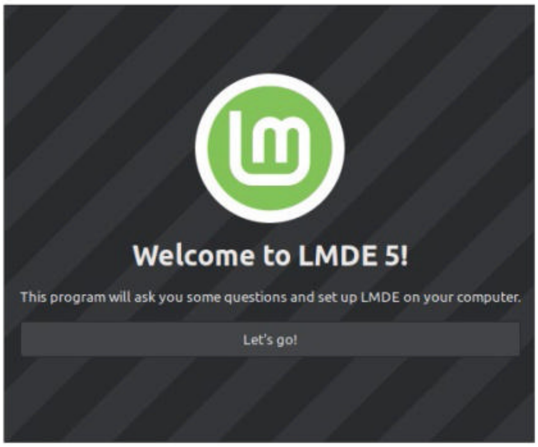
Dinosaur-era CPUs that don't support multimedia extensions (like SSE introduced with Pentium III chips circa 1999) generally don't support video decoding, so can't run modern web browsers (which would eat their allotted 4GB of RAM anyway). Moreover, a world of pain awaits anyone trying to run modern desktops on old graphics cards or integrated chipsets.

LEVEL UP YOUR LAPTOP

Let your laptop do a Lazarus with Linux Mint, even if it's 32-bit vintage

IMAGINE that you have an old laptop lying around. Suspend your disbelief and imagine further for a moment, against all odds, that you find its power supply, too. As you draw a deep breath and hit the (rather dirty) power button, the machine whirrs into life and a legacy BIOS logo appears on the screen. As the lengthy boot process ensues, the screen flickers and the hard drive chugs in an increasingly agitated fashion. A fan, reacting to the arduous work the CPU below is doing, spins faster and faster, emitting an unsettling whine. Exactly where our imaginary tale goes from here is up to you, but if you have an old laptop that seems to work, there's a good chance it can be made a lot more useful with Linux.

Before addressing the software, it's worth doing a hardware refresh as well. Compressed air through the vents and keyboard will clear out any dust, hopefully quelling that ominous fan noise. If you're feeling more adventurous, open your laptop so you can investigate more thoroughly. Don't spray chips and connectors at point blank range, though, as some are quite sensitive.


Welcome to LMDE 5!

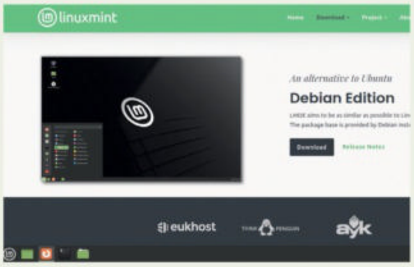
This program will ask you some questions and set up LMDE on your computer.

Your laptop's new life begins here. The installer walks you through the journey with ease.

Any PC upgrade should include a RAM boost. Indeed, if you were going for a bang-for-buck upgrade, RAM should be where you invest the most, so find out how much memory (Crucial's System Advisor has served us well in the past: https://www.crucial.com/upgrades) you have and how much your laptop model can handle. Most serviceable laptops have a convenient memory port on the underside. Open this to see how many slots are available for new SO-DIMMS (small outline dual in-line memory modules). They may all be populated (for example, two slots with a 1GB module in each), in which case you'll probably want to discard both modules and replace them with something more capacious (such as two 4GB modules, if supported). When buying more RAM, get the correct DDR version and frequency for your hardware. Unlike the old days, it's possible to mix and match module sizes, but it's best to use a matching pair (or pairs/a quartet if your laptop has four slots).

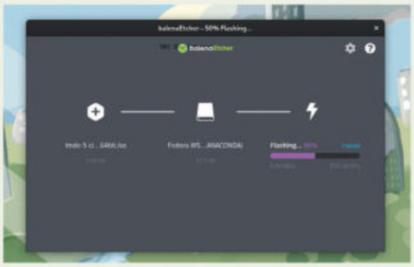
It's generally not possible to upgrade CPUs on laptops (old desktop upgrades tend to offer only minor

BOOT LMDE 5



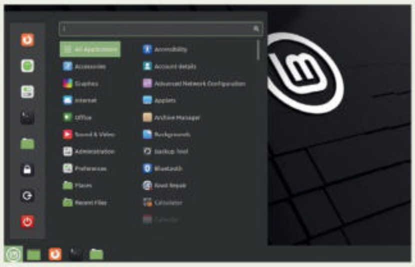
1. DOWNLOAD THE IMAGE

The LMDE download page is at https://linuxmint.com/download_lmde.php (or go to the main page for the official Ubuntu flavor). Hit Download, then fetch the torrent or choose a mirror (further down the page) to download the ISO file. You may have a tool for writing it to USB; if not, grab the cross-platform Balena Etcher from https://etcher.io/.



2. FLASH THE IMAGE

Start Balena Etcher (if you downloaded the AppImage, you need to `chmod +x` it; see the Etcher page for info), and point it to the LMDE image. Select your USB storage (hard drives and SSDs are marked with exclamation marks, so you don't do something you regret) and hit Flash. Wait for it to finish and verify, then reboot the machine.



3. BOOT THE LIVE ENVIRONMENT

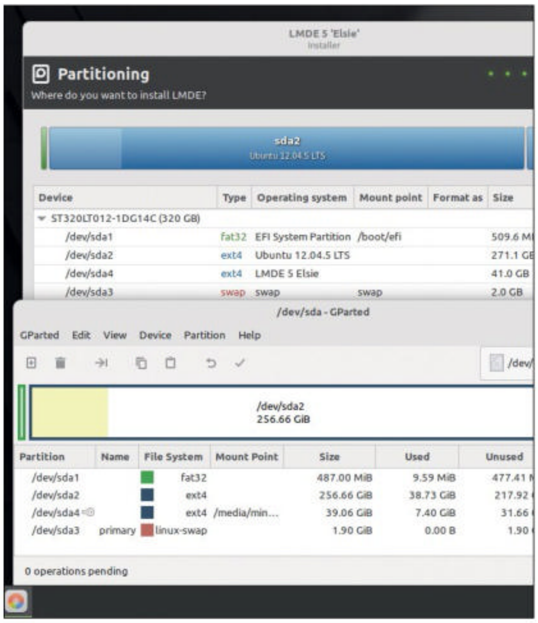
If you press F12 or F10 quickly enough, you might see a handy boot menu appear, which enables you to boot your freshly minted USB media directly. If not, you need to reboot and change the boot order from the BIOS or UEFI interface. If successful, select Start LMDE from the boot menu, and await the friendly startup chime.

speed bumps), so the next bit of hardware we'll address is that noisy hard drive. If your laptop has a 2.5-inch SATA bay inside, you can replace the incumbent drive with an SSD. Not only is this quieter, it's faster. If your laptop supports SATA 3, you'll enjoy read speeds of around 500 megabytes per second. If it doesn't, don't worry—modern drives are all backwards compatible, and you'll still enjoy their quieter operation. SSDs are remarkably cheap, too; canny shoppers can pick up a 240GB model for $15. Speaking of cheap, budget laptops of old tend to be sealed units that can't be readily upgraded, so don't try too hard to open these models. If you can get in without breaking it (they often are glued), you may be disappointed to find soldered-in RAM and storage.

Tame your UEFI

Before replacing your laptop's storage, check to see if there's any important data on there. You can always plug it in later (with a SATA-USB adapter), but you might also want to boot up the old OS to export browser passwords, bookmarks, or cryptocurrency wallets. Once you've upgraded your machine's insides, power it on and follow any on-screen guidance to enter the setup. Often this is done with Del, F10, or F2, but some devices require a more radical combination. Older machines have a BIOS (Basic Input/Output System) set up, while newer ones use the Universal Extensible Firmware Interface (UEFI).

Either way, you should be able to check that all RAM modules and the SSD are detected. There might be the option to tweak RAM timings, but this generally isn't required. It's possible, though unlikely, that your machine needs a firmware update to support some new hardware. UEFI machines often allow such updates from a USB stick or the OS. BIOS machines often need to be booted to a DOS-like environment (such as FreeDOS) to apply updates, which is beyond the scope of this outing. UEFI machines can emulate BIOS machines through a legacy mode. We don't recommend doing this unless you have reason to.



LMDE 5 'Elsie'
Installer

Partitioning
Where do you want to install LMDE?

sda2
Ubuntu 12.04.5 LTS

Device	Type	Operating system	Mount point	Format as	Size
ST320LT012-1DG14C (320 GB)					
/dev/sda1	fat32	EFI System Partition	/boot/efi		509.6 M
/dev/sda2	ext4	Ubuntu 12.04.5 LTS			271.1 G
/dev/sda4	ext4	LMDE 5 Elsie			41.0 GB
/dev/sda3	swap	swap	swap		2.0 GB

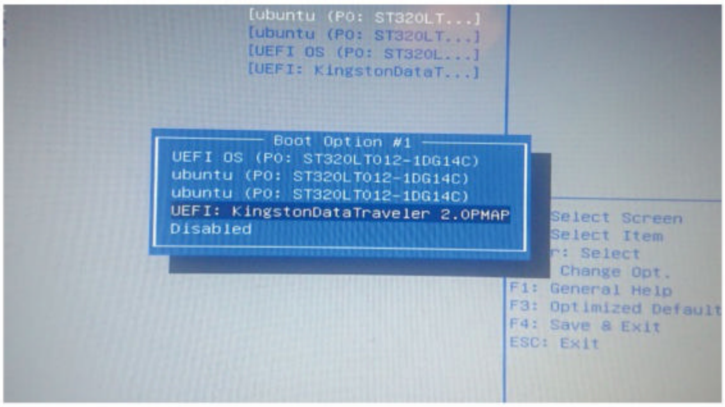
/dev/sda - GParted

/dev/sda2
256.66 GiB

Partition	Name	File System	Mount Point	Size	Used	Unused
/dev/sda1		🟩 fat32		487.00 MiB	9.59 MiB	477.41
/dev/sda2		■ ext4		256.66 GiB	38.73 GiB	217.92
/dev/sda4		■ ext4	/media/min...	39.06 GiB	7.40 GiB	31.66
/dev/sda3	primary	🟥 linux-swap		1.90 GiB	0.00 B	1.90

0 operations pending

Linux Mint supports installation alongside other operating systems if you'd rather not erase everything.



```
[ubuntu (P0: ST320LT...]
[ubuntu (P0: ST320LT...]
[UEFI OS (P0: ST320L...]
[UEFI: KingstonDataT...]

Boot Option #1
UEFI OS (P0: ST320LT012-1DG14C)
ubuntu (P0: ST320LT012-1DG14C)
ubuntu (P0: ST320LT012-1DG14C)
UEFI: KingstonDataTraveler 2.0PMAP
Disabled

Select Screen
Select Item
r: Select
 Change Opt.
F1: General Help
F3: Optimized Default
F4: Save & Exit
ESC: Exit
```

We dug out this decade-old laptop just to photograph its classy UEFI configuration.

UEFI is often criticized for its Secure Boot feature, which determines what operating systems are allowed to load. Many Linux distributions (including LMDE, which we'll look at in a moment) work fine with Secure Boot, but some don't, so you may want to disable this if you plan to distro-hop. Assuming everything looks fine in the firmware, we can move on to installing our minty-fresh OS. We'll look at the flagship edition of Linux Mint (based on Ubuntu) over the page, but just to mix it up, we'll use the slightly more adventurous Debian edition (LMDE) to enliven our laptops here.

Everyone loves Linux Mint

Apart from not liking Ubuntu, one reason to use LMDE is that it still supports 32-bit hardware. LMDE also follows Debian's release cadence, rather than that of the Ubuntu LTS, so most of the time, LMDE has older software than its Ubuntu counterpart. LMDE 5 (code-named Elsie and released in March 2022) is based on Debian 11, Buster, released in August 2021, as opposed to the Ubuntu LTS, which appeared in April 2022. Don't let this bother you—there are always ways to add new apps.

Follow the walk-through (opposite) to download LMDE 5 and start its live environment (these work on Linux and Windows). You can mess around here as much as you like without worrying about messing up your system. Nothing is written to the main storage (a RAM disk is used) until we install it, so it's worth taking time to explore the Cinnamon desktop environment. It comes with everything you need for bread-and-butter computing, and is intuitive to navigate. You probably don't need us to tell you that Wi-Fi networks can be found in the system tray in the bottom-right.

When you're suitably impressed with LMDE, double-click Install Linux Mint, then click Let's Go. You're greeted with a series of localization questions. If you're connected to the internet, the correct regions should be selected automagically. Next, you need to come up with a name for your computer, a username for yourself, and a password for your computer.

We're not going to cover advanced partitioning setups or dual booting; we'll just go with the Automated Installation option, which wipes your entire disk. If you know what you're doing, you may prefer to use the Manual Partitioning option here. Hit Next and heed the final warning before commencing the installation. Assuming that all goes well, you can reboot into LMDE at your leisure. The next pages are packed with tips about what to do with this fresh new operating system.

DEGAUSS YOUR DESKTOP

Say hello to Linux Mint 21 Vera, here to modernize your desktop PC

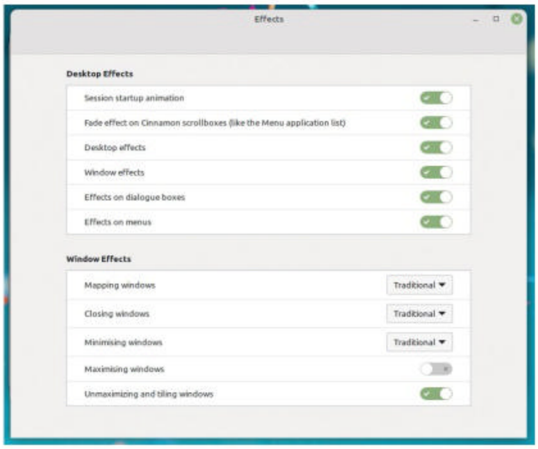
DESKTOP SYSTEMS are usually a little more flexible, upgrade-wise, than laptops. There's generally a lot more room to look around, which means a lot more space for dust to gather, too. RAM and SSD upgrades will probably, again, have the biggest impact, but you may also be tempted to replace your processor. If you want to get into gaming, you might want to put in new graphics card. Heck, you might want to rip out all the guts and replace the motherboard and everything else mentioned hitherto.

There certainly are bargain components to be had on auction sites and marketplaces, but these may be damaged and unscrupulous sellers will not refund you. Bear in mind also that components have a limited lifespan. Capacitors on motherboards pop, power supplies (PSUs) fail, and fans become noisy. Rather than entrusting your critical business to hodgepodge hardware, we strongly advise getting new parts. That notwithstanding, going Frankenstein on older machines is fun, and you probably can't buy new components for them easily. Just don't use said the resulting Frankenputer for anything crucial. Oh, and consider power efficiency—they may not need a lightning strike to come to life, but older machines aren't as good at saving power when idle as their newer counterparts.

However you choose to source your components, it's of paramount importance to check compatibility. If you get the fastest possible CPU for a given motherboard, that board may need a firmware update in order to work with it. If you get a fancy graphics card (see box), you may need extra PCI Express power connectors (or a whole new PSU) to power it. If it's a chunky, fancy graphics card, there may be space considerations. If you're getting a new heatsink or fan (or investing in watercooling), this can be an issue, too.

As with upgrading RAM on laptops, take care to ensure compatibility. Modern mobos might let you run four 8GB DIMMs in quad-rank quad-channel quad-damage mode (one of those isn't real), but this is only going to benefit specific applications. The minimum we recommend for a desktop machine is 16GB. We can hear some of you crying overkill, so let us explain: you can certainly run a lovely desktop with four, but a modern web browser will eat that up in no time. You may not be interested in using the machine as an everyday desktop, in which case you can get away with less. Linux Mint installs on a machine with only 2GB, and there are lightweight distros that require even less.

We're going to pretend we've installed the flagship edition of Linux Mint on our freshly upgraded machine. This only supports 64-bit machinery, so if you have a 32-bit machine, use the three-step guide for the Debian edition on the previous page. In fact, use those instructions for the flagship Ubuntu edition, too—they have been made just about recyclable in this case. Again, take some time to enjoy the live environment and get a feel for how things work in the spicy Cinnamon desktop (or mighty MATE or excellent Xfce desktops, if you fancy trying a different flavor).



Desktop Effects

Session startup animation	●
Fade effect on Cinnamon scrollboxes (like the Menu application list)	●
Desktop effects	●
Window effects	●
Effects on dialogue boxes	●
Effects on menus	●

Window Effects

Mapping windows	Traditional
Closing windows	Traditional
Minimising windows	Traditional
Maximising windows	○
Unmaximizing and tiling windows	●

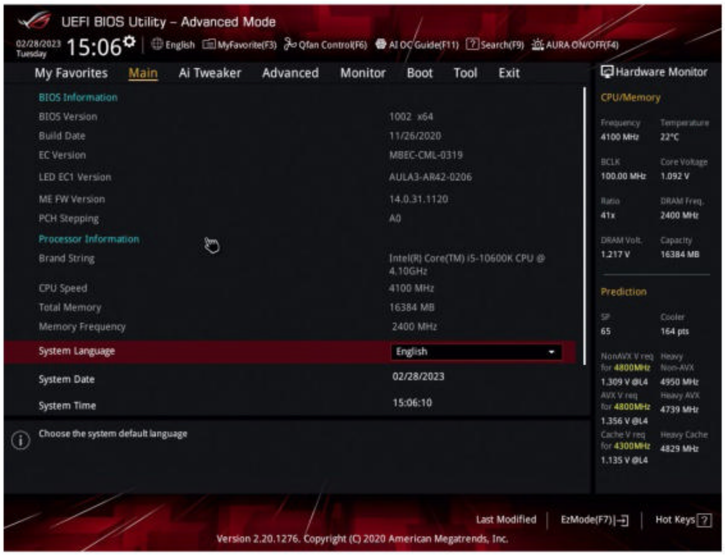
Cinnamon enables you to disable this kind of desktop po-up, which is useful if your GPU is very old.

UPPING YOUR GRAPHICS GAME

Modern integrated graphics are surprisingly good, as in playing AAA games at 1080p good. These days, they're part of the CPU package, but in times gone by, they were integrated on the motherboard, and they weren't that good. If your machine has such hardware, you may want to upgrade to a beefier GPU, in which case you may well want some information about drivers.

AMD and Intel (who now produce discrete cards, too) have long contributed open source drivers to the Linux kernel, so you should expect their cards to work out of the box. Nvidia hardware ought to work, too—its proprietary drivers are now bundled with Ubuntu. Check this from the Driver Manager in the Administration section in the main menu. You may be using the open source Nouveau driver instead. This is fine unless you need 3D acceleration, in which case you can switch to the naughty proprietary kernel module. There's an official PPA if you want a bleeding-edge graphics stack—see https://launchpad.net/~graphics-drivers/+archive/ubuntu/ppa.

The Windows way of downloading drivers from manufacturers' websites is largely frowned upon in Linux. Open source drivers (for all hardware, not just GPUs) are included in the kernel, and distros do a fine job of making sure these work out of the box. Ubuntu includes lots of proprietary drivers and firmware, too, so you shouldn't need to go hunting around the internet for hardware that needs these. There are always exceptions, though—some Wi-Fi devices need firmware that can't be redistributed, so you need to extract this yourself.



BIOS Information
BIOS Version 1002 x64
Build Date 11/26/2020
EC Version MBEC-CML-0319
LED EC1 Version AULA3-AR42-0206
ME FW Version 14.0.31.1120
PCH Stepping A0
Processor Information
Brand String Intel(R) Core(TM) i5-10600K CPU @ 4.10GHz
CPU Speed 4100 MHz
Total Memory 16384 MB
Memory Frequency 2400 MHz
System Language English
System Date 02/28/2023
System Time 15:06:10
Choose the system default language

CPU/Memory
Frequency 4100 MHz
Temperature 22°C
BCLK 100.00 MHz
Core Voltage 1.092 V
Ratio 41x
DRAM Freq. 2400 MHz
DRAM Volt. 1.217 V
Capacity 16384 MB

Prediction
SP 65
Cooler 164 pts
NonAVX V req for 4800MHz 1.309 V @L4
Heavy Non-AVX 4950 MHz
AVX V req for 4800MHz 1.356 V @L4
Heavy AVX 4739 MHz
Cache V req for 4300MHz 1.135 V @L4
Heavy Cache 4829 MHz

Version 2.20.1276. Copyright (C) 2020 American Megatrends, Inc.

A modern motherboard's UEFI interface even allows you to take screenshots.

The live environment comes with most of what you'll find once Mint is installed—that is to say, everything you need to conduct your digital business. There's Firefox (the thinking person's web browser), the LibreOffice suite (almost entirely compatible with Microsoft Office and cloud office offerings), and all the usual de-rigueur tools and utilities. Don't worry if it seems a little slow and clunky—this is mostly because it's running from USB. Once properly installed, the experience will be much smoother.

Apart from a slightly slicker installer, the process for the Ubuntu edition is much the same as the Debian-based situation on the previous pages. Just hit the Install icon on the desktop. We won't cover complex partitioning arrangements, as we'd be here all day, but we will say be very careful if you're setting up dual boot, especially if your plan involves resizing Windows partitions. We strongly recommend using a new drive dedicated to our imminent Mint install instead. Either way, we'll reiterate our advice to back up anything important before installing a new OS.

Having been gently guided through the install process (see the boxout over the page if you want to tweak swap settings), reboot your computer and log in to your new operating system. You'll be greeted by the welcome wizard. Go to the First Steps tab, where you can choose between light and dark themes, or choose a highlight color (for some reason, green is unpopular with Linux users—just ask the Bodhi Linux team).

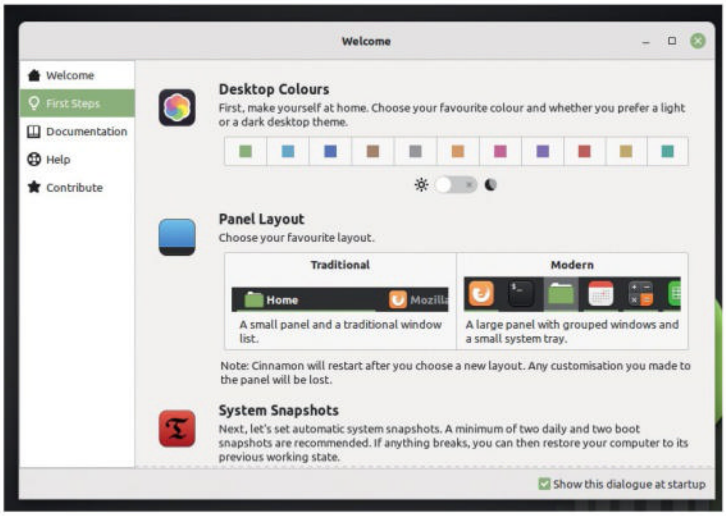
Less cosmetically, you can also set up system snapshots with TimeShift from here. These defend against rogue system updates (which shouldn't happen, but do) and enable you to easily roll back the system to a known good state. TimeShift isn't ideal for backing up personal files and, by default, doesn't include your home directory, in order to keep snapshots small (though you can force its hand). A dedicated utility such as Déjà Dup (available from the Software Manager) is better suited to this task.

If you want to play certain media formats, you may need proprietary codecs to do so. These can also be installed from the welcome wizard. Most media from streaming websites uses freely licensed codecs (and lots of problematic patents have expired over the last five years), so this package is less important than it used to be.

Next in these first few steps is the Update Manager. Sooner or later, it will pop up to nag you, so you may as well do this now. It asks if you want to switch to a local mirror (for the Mint-specific packages, the underlying Ubuntu, or Debian, system is updated from Canonical's, or Debian's, repositories), which ought to speed up updates slightly. You'll probably be told that an (Inception-like) update to the Update Manager is available during all of this, but that should be swift and painless.

Mint 21.1 was released in December 2022, so the first lot of updates (if you didn't tick the Download Updates During Install box) might take longer than usual. Don't worry though, because updates on Linux are not the painful, hour-long, reboot-ridden trauma that they are on Windows. You are in control, but you should not ignore that little shield notification when it pops up. Exploits and malware do target Linux, and it's nice to get any bug fixes before the corresponding bugs bite you.

Some people integrate system updates into their daily practice, but so long as you update at least weekly, you'll be fine. Problems occasionally arise if updates are left for too long and transition packages are missed. It's rare these days (as long as you don't have an Nvidia GPU) for an update to result in the dreaded rebooting to a black screen, kernel panic, or GRUB rescue prompt, but so many forum posts affirm that it does happen. This is why you should heed our TimeShift advice. Even on an unbootable system, you can boot the Mint live environment and roll back your system from there. Assuming your system is bootable, head on over the page to put the final touches to your Mint install.



Desktop Colours
First, make yourself at home. Choose your favourite colour and whether you prefer a light or a dark desktop theme.

Panel Layout
Choose your favourite layout.
Traditional: A small panel and a traditional window list.
Modern: A large panel with grouped windows and a small system tray.
Note: Cinnamon will restart after you choose a new layout. Any customisation you made to the panel will be lost.

System Snapshots
Next, let's set automatic system snapshots. A minimum of two daily and two boot snapshots are recommended. If anything breaks, you can then restore your computer to its previous working state.

☑ Show this dialogue at startup

This helpful welcome wizard helps acclimatize you to new Minty climes. Don't forget to check out the documentation.

TWEAKING AND TESTING

Peek into Linux's internals and ensure your machine is healthy. Plus, learn some command-line secrets

IF YOU'VE FOLLOWED ALONG this far and your upgraded machine now boots Linux, connects to the internet, and doesn't crash, then bravo! You are doing better than us. If, on the other hand, something is not working as expected, you'll want to dig deeper with some diagnostics. Common sore points include (but are not limited to) audio, graphical stutter, disk space running out (this can happen very quickly if you try to squeeze Mint into a small space), and media not playing. Laptops have their own peculiarities, so make sure that your laptop's hotkeys (in particular brightness controls), Bluetooth, and Wi-Fi are all working as expected.

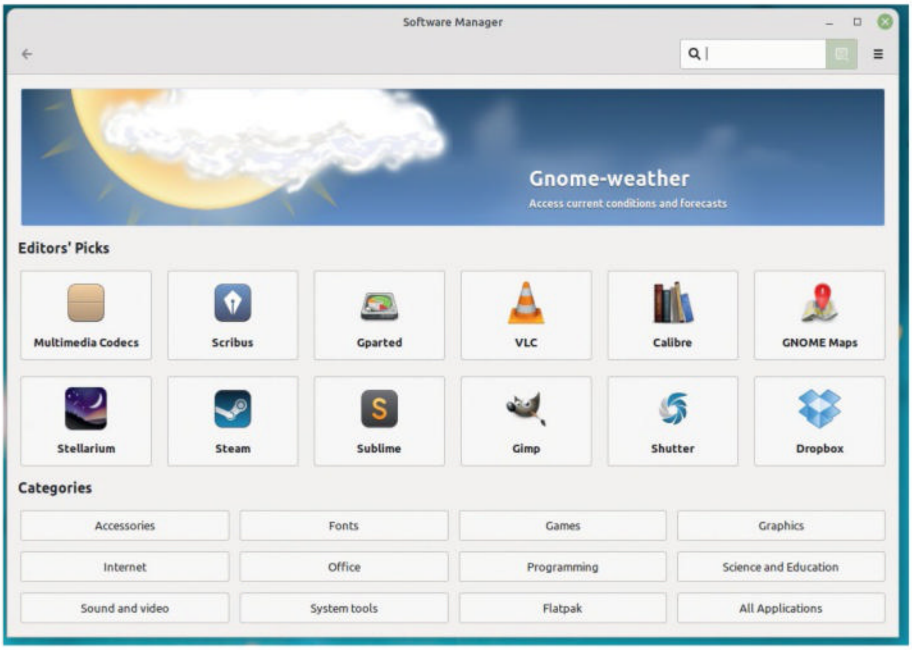
Hybrid graphics found on laptops have long been problematic on Linux. Nvidia Optimus laptops, for example, feature a low-power, integrated GPU and a gruntier discrete GPU from Nvidia. Ideally, the latter is only used when needed, preserving battery life. The Bumblebee project used to support this (at least for Intel iGPUs), though that project isn't being maintained these days. The Nvidia settings application enables you to set this up, and GPU offloading (where you can tell an application to run on the fast GPU) is integrated on the Gnome desktop. In theory, you can get this to work anywhere (such as on our Cinnamon desktop) with some command-line fu.

Oh, and if everything grinds to a halt when you open a web browser, check out the box opposite about swap space. Browsers use a ton of memory, and any more than a couple of open tabs easily chews through 4GB. So, while memory-limited hardware is still good for a lot of things, browsing modern websites is not one of them. SSDs with fast random read and write speeds can mitigate the situation to some extent. You'll probably run into problems with the Mint graphical installer if you try to run it with less than 1GB of RAM, so here you'll have to recourse to a different Linux flavor. Bodhi Linux, Slax, and antiX do very well in these situations. Alternatively, you might prefer the 32-bit Arch Linux community flavor, if you're that kind of person.

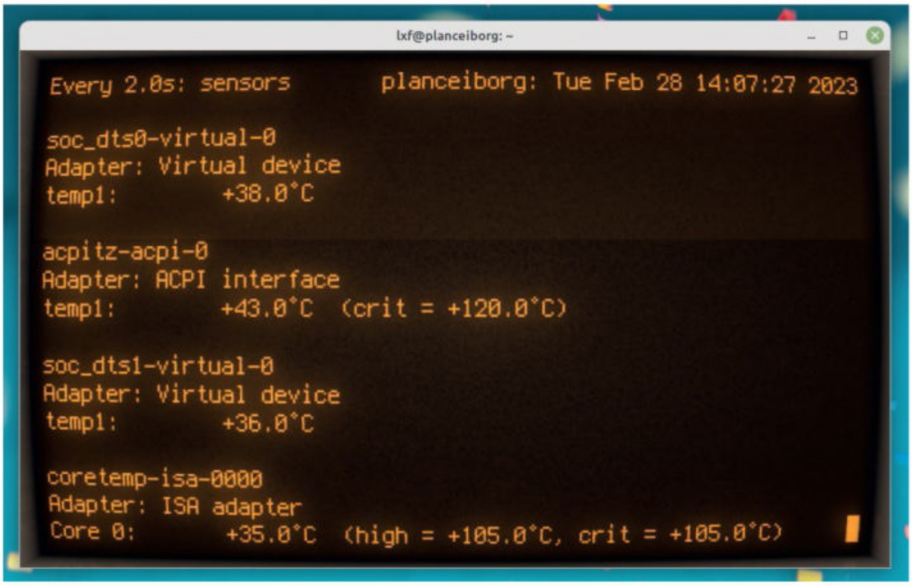
Even if everything appears to work fine, it's worth looking under the hood to check everything is indeed okay. You'll find System Monitor in the Administration menu. This firstly provides a list of running processes and how much memory and CPU they're using. If things go awry, check here to see if a misbehaving program is hogging one of these resources. Move to the Resources tab to see overall usage figures and smoothly updated graphs. The File Systems tab shows you how things are going disk space-wise.

You might notice in here (or from your BIOS or UEFI) that not all your RAM is detected, in which case you should first check that it is seated correctly in the slots. If that doesn't fix it, you may have a dead DIMM, a dead slot, or just bad luck. Try swapping DIMMs around (carefully—they are sensitive to both static and being dropped or scratched) to isolate the problem. It's rare to run into compatibility problems on modern systems (beyond getting the wrong generation of memory; G.Skill has a configurator at https://gskill.com/configurator to help avoid this), but older mobos used to be fussy about this. You need to dig up the manuals in this case. Usually, RAM banks should be filled starting nearest the CPU. But this is not a universal rule, so the matter may be solved by shuffling DIMMs around.

To dig even deeper, open the System Logs application (also in the Administration menu) to see whether any programs or hardware are upset. In general, Linux writes quite verbosely in the system journal about what it's up to, so the System Logs application shows only the important messages when you open it. You can turn off the filter, or restrict it to other subjects from the list on the left. Even if there are some scary sounding alerts here, they might not really be a cause for concern. For example, our laptop complained about a missing PCM device (because it doesn't support 7.1 sound) and debug firmware for the Wi-Fi (which we didn't want to debug). Newer messages are listed first, so it can be helpful to watch this while



Head to Mint's Software Manager to find and install all kinds of wonderful applications.



```
Every 2.0s: sensors        planceiborg: Tue Feb 28 14:07:27 2023

soc_dts0-virtual-0
Adapter: Virtual device
temp1:        +38.0°C

acpitz-acpi-0
Adapter: ACPI interface
temp1:        +43.0°C  (crit = +120.0°C)

soc_dts1-virtual-0
Adapter: Virtual device
temp1:        +36.0°C

coretemp-isa-0000
Adapter: ISA adapter
Core 0:        +35.0°C  (high = +105.0°C, crit = +105.0°C)
```

For added pizzazz, run lm_sensors in CoolRetroTerm. You can almost feel the electrons burning your retinae.

opening problematic applications and such. If your machine is subject to random crashes (not that Linux ever crashes), you might be lucky enough to catch a telltale error message here when it does.

We haven't mentioned it yet (because market research shows it scares people off), but you can do pretty much everything and anything from the command line in Linux. The system can be monitored with `top`, updated with `apt`, and have its logs scrutinized with `journalctl`, for example. The terminal program (found on the shortcut bar next to the Firefox icon, or in the Administration menu) is our gateway to command-line interactions. Let's use it to install some software that will help with our cursory diagnostics.

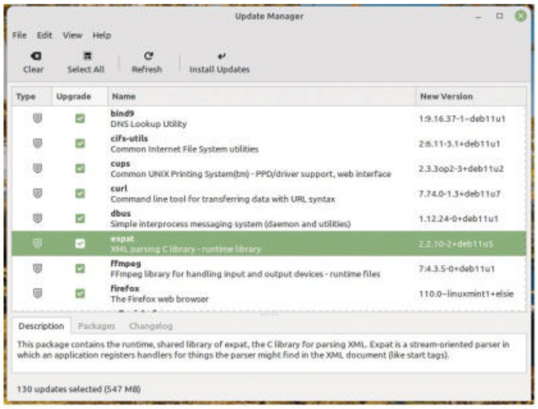
Assuming your system was recently updated, typing

```
$ sudo apt install lm_sensors
```

should first give you a stern warning about power and responsibility. You probably found yourself having to type in your password more times than you felt comfortable with during the first update. This is because Linux takes security seriously, and the user needs to be aware when they're using their administrative privileges, so you won't mind typing it in again here. That's what the `sudo` command deals with, while the `apt install` part uses those privileges to install things, in this case the lm_sensors package.

LM Sensors is able to read sensors (temperatures, fan speeds, and other variables) from a huge range of hardware. It's been around for a very long time, and these days works out of the box for most hardware. Try it by running `sensors`. You should see a variety of potentially useful readings. If you see an error to the effect that no sensors were detected, try running the `sensors-detect` script first. To make this even more useful, we can use it as a real-time monitoring tool, by combining it with another command. Try running the following instead:

```
$ watch sensors
```



Type	Upgrade	Name	New Version
	☑	**bind9** DNS Lookup Utility	1:9.16.37-1~deb11u1
	☑	**cifs-utils** Common Internet File System utilities	2:6.11-3.1+deb11u1
	☑	**cups** Common UNIX Printing System(tm) - PPD/driver support, web interface	2.3.3op2-3+deb11u2
	☑	**curl** Command line tool for transferring data with URL syntax	7.74.0-1.3+deb11u7
	☑	**dbus** Simple interprocess messaging system (daemon and utilities)	1.12.24-0+deb11u1
	☑	**expat** XML parsing C library - runtime library	2.2.10-2+deb11u5
	☑	**ffmpeg** FFmpeg library for handling input and output devices - runtime files	7:4.3.5-0+deb11u1
	☑	**firefox** The Firefox web browser	110.0~linuxmint1+elsie

This package contains the runtime, shared library of expat, the C library for parsing XML. Expat is a stream-oriented parser in which an application registers handlers for things the parser might find in the XML document (like start tags).

130 updates selected (547 MB)

If you keep on top of your updates, then the nagging will stop.

Hey presto, the lightest hardware monitor in the world. Try taxing your CPU or graphics card with this running to see how hot the machine's internals are getting. Of course, graphical programs are available that do this (such as Psensor), but command-line tricks like this are always useful. You can stop the sensor monitoring by pressing Ctrl+C.

The latest Linux Mint release, Victoria, is available to buy now.

SWAP SPACE

It's worth taking a moment to talk about swap space. Swapping (using disk space as memory when actual RAM is running low) has been a staple of computing since as long as there have been disks. No one has ever liked swapping (accessing disks, or even flash storage, is magnitudes of order slower than RAM), but it is marginally better than the alternative—having random applications summarily killed to reduce memory pressure.

A rule of thumb (with dubious origins) used to be that the operating system should have twice as much swap space as system RAM. This is still reasonable on old systems (ones with less than 4GB RAM), but for machines with 32GB, it almost certainly makes no sense to sacrifice 64GB of disk only for a tiny fraction ever to be used. A better formula for modern systems (with more than 8GB) is 20 percent of RAM. But it all depends on your (and your favorite applications') memory usage habits.

A default install of Linux Mint creates a swap file, and LMDE gives you a swap partition instead (on our ageing laptop, this was 2GB). It's easy to resize swap files (and not impossible to resize swap partitions), so you don't need to re-install if you have to change this. Don't worry if this all means nothing to you. You can find out more at www.redhat.com/en/blog/do-we-really-need-swap-modern-systems. Or, if you want to learn about the ins and outs of the installer, check the official documentation at https://linuxmint-installation-guide.readthedocs.io/en/latest/.

DISCOVER THE ALTERNATIVE TO APPLE AND WINDOWS

This is a treasure-trove of Linux and open source knowledge, from the evolution of Ubuntu and its mobile platform, to projects like automating your home with Raspberry Pi.

NEW
LINUX FORMAT
2023 ANNUAL
OVER 160 PAGES OF EXPERT TUTORIALS & MUST-READ FEATURES
» ESSENTIAL PROJECTS
» UBUNTU VS FEDORA
» COMBAT MALWARE
» CUSTOMISE MINT
AND MUCH MORE!
ALL THE BEST CONTENT FROM THE NO.1 LINUX MAGAZINE
Linux Format Annual 2023
ISBN 978-1-80308-401-5
FUTURE
VOLUME 6

ON SALE NOW

FUTURE

Ordering is easy. Go online at:

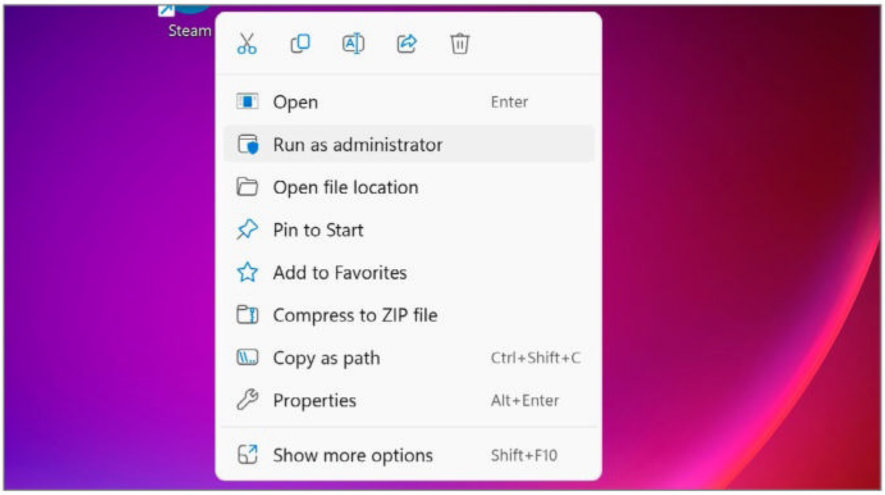
magazinesdirect.com

Or get it from selected supermarkets & newsagents

HOW TO

STEP-BY-STEP GUIDES TO IMPROVING YOUR PC

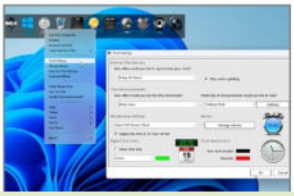
TIP OF THE MONTH



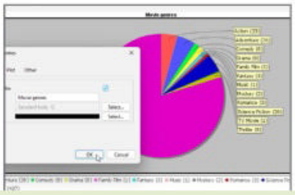
RUN APPS AS ADMINISTRATOR

If an application isn't running normally or you've just downloaded a new program and the installation isn't going well, opening the app as an administrator may solve your woes. This allows you to gain full access to the app with the highest privileges. One of the easiest ways to do this is to right-click it and select 'run as administrator'. Alternatively, right click, select properties, then in the compatibility section tick 'Run this program as an administrator' to always run it in this way.

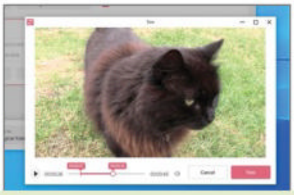
MAKE – USE – CREATE



62 Spruce up the Taskbar via customization



66 Build up your own database with Data Crow



70 Convert videos easily with presets

© © WWW.WINSTEP.NET, DATA CROW, ICECREAM VIDEO CONVERTER

SAM LEWIS
STAFF WRITER

THE WINNER IS...

I had a dilemma. The choice was essentially between choosing a new handheld gaming system—the Asus ROG Ally—or swaying away from games and towards music by picking up a pair of Sony's WH-1000XM5s. If you've watched the video covering our last build, then you'll know that I was just about to embark on a vacation, and it was while I was out there that I realized what road I wanted to go down. Sorry Asus and handheld gaming, I need to amp up my audio experience. My trusty Airpods didn't provide me with the clarity, depth, or noise cancellation that I needed.

I remember testing the previous-gen Sony WH-1000XM4s and feeling completely immersed in the sound. I didn't feel this when I was flying, traveling from the airport and to the hotel, or by the beach or pool. There were certainly points where I would have also enjoyed having the Asus ROG Ally with me, but I'd argue that this sits on the other end of the spectrum to listening to music. You need more attention and concentration—two things I left at home! I'm also lucky to be able to game on all of the custom PCs we make and laptops we review, which makes the Sony WH-1000XM5 an easier choice. The bill won't be tasty, but at least I'll be able to get some chill-out time, which I recommend everyone should make time for!

↘ submit your How To project idea to: editor@maximumpc.com

Spruce up the Taskbar

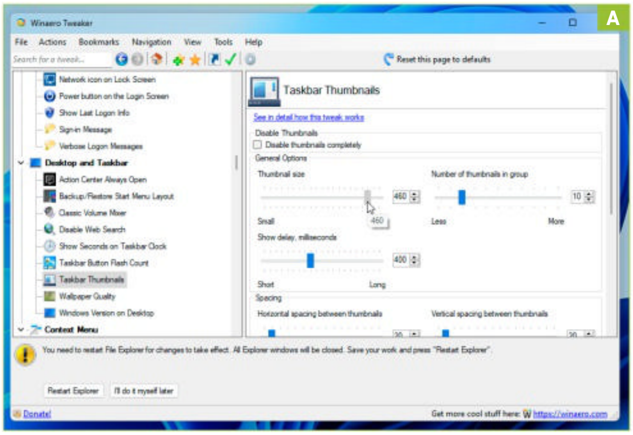
YOU'LL NEED THIS

WINSTEP NEXUS
(free, www.winstep.net/nexus.asp), a collection of free taskbar tweakers for less drastic changes

THE WINDOWS TASKBAR is an essential part of any PC's desktop. It's where you pin shortcuts to apps, access the Start menu, and monitor your system via a range of icons in the Notification area (or system tray, as it used to be called). With the release of Windows 11, Microsoft has rewritten the Taskbar's underlying code, so if you're unhappy with changes it has made, there's not a lot you can do about it with the help of third-party tools.

Or is there? In this tutorial, we'll examine two different approaches. The first is to tweak the Taskbar as it is, plus look at how you can bring back the 'classic' Taskbar (which still lurks under Windows 11's hood for now) to provide you with additional options to customize it to your needs.

The second is to take a more radical approach. This favors ditching the Taskbar in favor of a macOS-style dock. The dock can be placed anywhere on your desktop, arranged horizontally or vertically, and packed with additional functionality in the form of system shortcuts and other widgets. Whether you want a better Taskbar or a new dock, this tutorial is for you. **–NICK PEERS**


A
Winaero Tweaker
File
Actions
Bookmarks
Navigation
View
Tools
Help
Search for a tweak...
Reset this page to defaults
Network icon on Lock Screen
Power button on the Login Screen
Show Last Logon Info
Sign-in Message
Verbose Logon Messages
Desktop and Taskbar
Action Center Always Open
Backup/Restore Start Menu Layout
Classic Volume Mixer
Disable Web Search
Show Seconds on Taskbar Clock
Taskbar Button Flash Count
Taskbar Thumbnails
Wallpaper Quality
Windows Version on Desktop
Context Menu
Taskbar Thumbnails
See in detail how this tweak works
Restart Explorer
I'll do it myself later
Donate!
Get more cool stuff here: https://winaero.com

Disable Thumbnails
☐ Disable thumbnails completely
General Options
Thumbnail size: 460 (Small – Large)
Number of thumbnails in group: 10 (Less – More)
Show delay, milliseconds: 400 (Short – Long)
Spacing
Horizontal spacing between thumbnails: 20
Vertical spacing between thumbnails: 20

You need to restart File Explorer for changes to take effect. All Explorer windows will be closed. Save your work and press "Restart Explorer".

1 SIMPLE TWEAKS

Let's begin by addressing some of the most annoying aspects of the Windows Taskbar. Right-click the Taskbar and choose 'Taskbar settings' to access its settings under System. Two areas of interest stand out: the ability to remove unwanted additions in the form of the clickbait-heavy Widgets shortcut, and the Chat shortcut that's superfluous to most.

» The second area can be found by expanding 'Taskbar behaviors' where you can realign the Taskbar's icons to the left, so the Start menu is in its old, favored place. Other options worth examining include 'Automatically hide the taskbar'—useful for freeing up a bit more screen real estate on small displays—and 'Other system tray icons', which lets you determine which app icons are allowed to take up permanent residence on the Taskbar as opposed to being hidden behind the ^ button.

2 DIG A LITTLE DEEPER

The Windows 11 Taskbar may look like its predecessors, but under the hood it's a complete rebuild. As a result, many tweaking tools that claim to give you more control over the Taskbar may not be able to deliver on all their promises. A case in point is the excellent 7+ Taskbar Tweaker tool (https://tweaker.ramensoftware.com/), which doesn't support Windows 11.

» That's not to say you can't tweak the Windows 11 taskbar with third-party tools—far from it—just be aware that some tweaks may have no effect unless you start patching Explorer itself to restore the 'classic' Taskbar (see the boxout across the page). One tweak that works in Windows 11, as well as earlier versions, is the ability to customize the thumbnail previews that pop up whenever you roll the mouse over an open program's taskbar icon. You will find such a setting in both Winaero Tweaker (https://winaerotweaker.com/) under Desktop and Taskbar > Taskbar Thumbnails as shown in [**Image A**], and Ultimate Windows Tweaker 5.1 (www.thewindowsclub.com/downloads/UWT5.zip) under Customization > Taskbar.

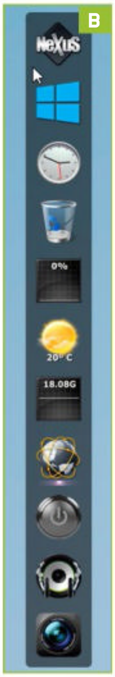
3 DITCH THE TASKBAR

If you're utterly fed up with the Taskbar, then a more radical solution is to replace it with a third-party dock. A dock works in a similar way to the Taskbar, but you're given greater control over what goes on it, how items are arranged, and even where you place it on the desktop.

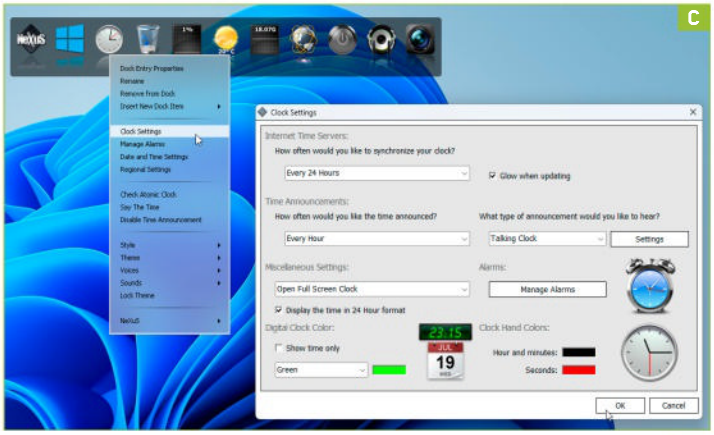
» Our dock of choice is Winstep Nexus, which comes in free (for personal use) and paid-for (Ultimate) builds. We're focusing on the free version in this tutorial. Nexus is designed to closely mirror what you get from the Taskbar, so it will display running apps and—if you apply the classic Taskbar tweak—give you access to your Notification area shortcuts too.

» Start by heading over to www.winstep.net/nexus.asp and click Download under the free version to save nexus.zip to your hard drive. Once downloaded, extract NexusSetup.exe and double-click it to run through the installer, which is simple and quick to follow. Once this is complete, leave 'Launch Nexus' checked and click Finish.

» After a short pause, you will see the dock appear at the top of the screen. Unlike the Taskbar, this can reside anywhere


B
NeXuS
0%
20° C
18.08G

© WWW.WINSTEP.NET



Clock Settings

Internet Time Servers:
How often would you like to synchronize your clock? Every 24 Hours
☑ Glow when updating

Time Announcements:
How often would you like the time announced? Every Hour
What type of announcement would you like to hear? Talking Clock

Miscellaneous Settings: Open Full Screen Clock
☑ Display the time in 24 Hour format

Alarms:

Digital Clock Color:
☐ Show time only
Green

Clock Hand Colors:
Hour and minutes: ■
Seconds: 🟥

you like—in horizontal or vertical format. Click and drag it into position—snap it to the sides to switch to vertical alignment, as shown in [**Image B**], or to the top or bottom to revert it back to horizontal alignment.

4 MASTER THE BASICS

The default install of Nexus provides you with 11 shortcuts icons—on the left is the Nexus button, which you click to open its settings or right-click to access a shortcut menu. More on that shortly. Next to this is a shortcut to the Start menu—note, however, that right-clicking it doesn't bring up the alternative Start menu (press Win + X), but reveals options for removing and renaming the shortcut, accessing its properties screen, and adding a new item to the dock.

» You'll see that a Recycle bin shortcut is present along with a series of buttons that point to several widgets Nexus offers: a clock, CPU and RAM meters, weather display, shortcut to your default browser, a button for toggling fast boot on and off, plus shortcuts to a simple media player and desktop screenshot capture tool.

» Widgets come in one of two types: Modules and Internal Commands. They are pre-installed with Nexus to showcase what the dock offers over your basic taskbar, and some will be more useful than others. Right-click each in turn, and you'll see that they all offer context-sensitive options specific to that widget. Take the clock, for example—choose Clock Settings, and you'll be shown a separate dialog [**Image C**] where you can disable the talking clock and customize whichever style clock face (digital or analog) you prefer. You can also set up various alarms, access hard-to-access Windows dialogs for both clock and regional settings, plus customize the style and theme of the icon itself.

5 SET UP YOUR DOCK

Take the time to go through each module in turn—any redundant features, like the fast boot toggle, can be removed by being dragged on to the dock's Recycle bin, or by right-clicking it and choosing 'Remove from dock'.

» To start adding your choice of icons to the dock, right-click any item and click 'Insert New Dock Item' to open a submenu. You'll see two options for adding the system tray and any open applications to the dock. Open apps will appear to the right of any existing icons, with a separator between the two sections. Many of these apps will be displayed with a thumbnail preview of the currently open window, while others simply show the app icon.

» The system tray option is, sadly, plagued by the same issues as other Windows Taskbar tweaks—namely, Microsoft's rewrite of the code means that it doesn't currently work in Windows 11. If you're running Windows 10 or have implemented the tweak in the first box to restore the classic Taskbar, then enabling this will allow you to access your Notification area icons from Nexus. By default, this means that any Notification area icons pinned to the taskbar will show up in Nexus to the right of an Expand button that, when clicked, reveals the rest via the familiar pop-up.

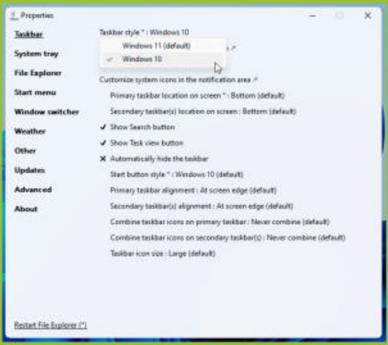
» All icons work in the same way they do in the taskbar, so right-clicking brings up their usual context menu. The default configuration has each icon displayed individually, which takes up a lot of room and results in blurry icons. To rectify this, right-click the Nexus icon and choose Preferences to open Nexus's main preferences. Switch to the Content tab and check 'Group system tray icons', as shown in [**Image D**], and click Apply to preview the effect.

RESTORE CLASSIC TASKBAR

If you're looking to restore compatibility with earlier versions of the Taskbar in Windows 11, there's a simple path you can follow. Once you've taken a fresh backup of your system drive (just in case), head over to https://github.com/valinet/ExplorerPatcher/ and click Releases. Expand Assets under the latest version and save ep_setup.exe to your hard drive.

Once done, double-click the file and click 'More Info > Run anyway' when prompted by the SmartScreen filter. Explorer will blank as it restarts and after a short pause a 'new' (or rather, 'old') Taskbar will appear. At first, it'll appear non-functional, but be patient—after a minute or so it'll suddenly pick up where the previous Taskbar left off. It'll look like a hybrid of old and new, but will function well, and can be tweaked in the usual way via Settings > Personalization > Taskbar. Crucially, all third-party apps and tweaks will work perfectly with it, including Nexus.

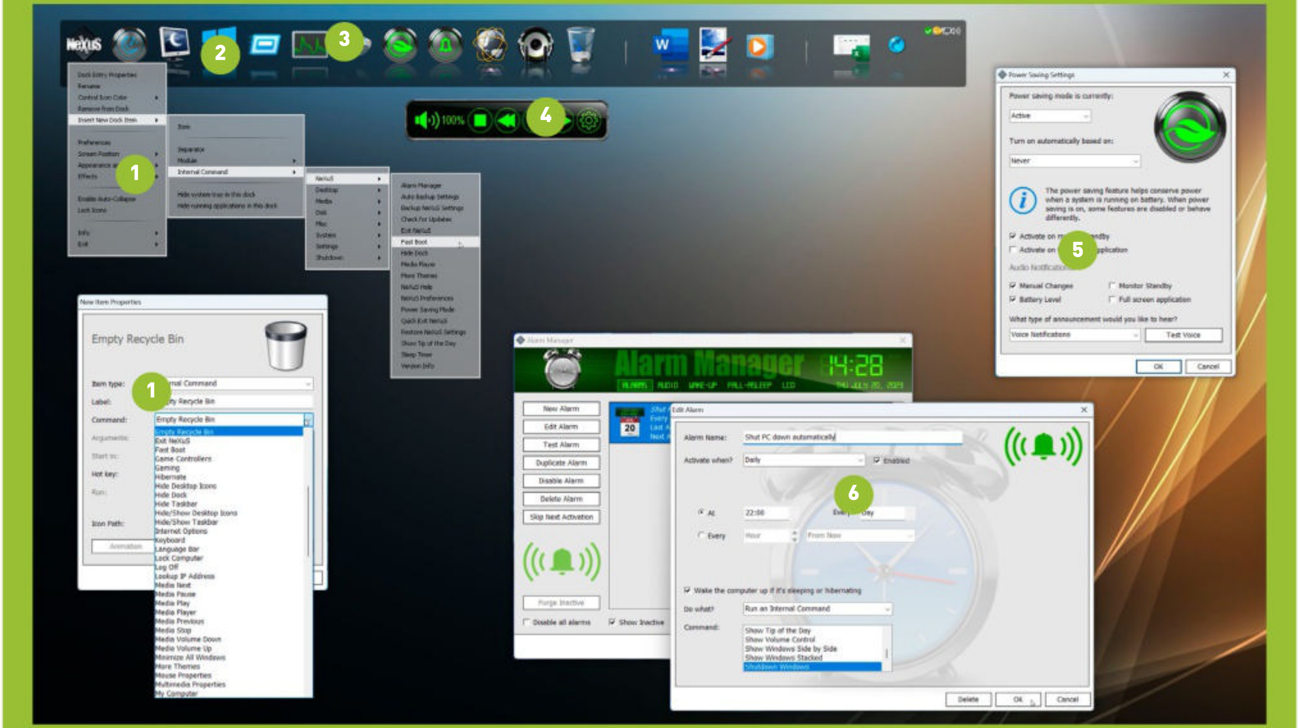
To tweak your new Taskbar settings (including switching between Windows 10 and 11 Taskbars with a single click), right-click the Taskbar and choose Properties. Explorer Patcher can also be used to tweak other aspects of Windows too—see https://github.com/valinet/ExplorerPatcher/wiki/ for a complete guide.



Taskbar style * : Windows 10
Customize system icons in the notification area ↗
Primary taskbar location on screen * : Bottom (default)
Secondary taskbar(s) location on screen : Bottom (default)
✓ Show Search button
✓ Show Task view button
✗ Automatically hide the taskbar
Start button style * : Windows 10 (default)
Primary taskbar alignment : At screen edge (default)
Secondary taskbar(s) alignment : At screen edge (default)
Combine taskbar icons on primary taskbar : Never combine (default)
Combine taskbar icons on secondary taskbar(s) : Never combine (default)
Taskbar icon size : Large (default)

» Explorer Patcher can restore the classic Taskbar.

ADD INTERNAL COMMAND WIDGETS



1. BROWSE AVAILABLE OPTIONS
If creating a new item by right-clicking on the dock, you can browse available commands via category. Alternatively, choose 'New Dock Item > Item' and switch 'Item type' to 'Internal Command' to browse the full A-Z list.

2. SWITCH OFF DISPLAY
These two buttons let you either replace the current display with a screensaver that shows the current time, or simply power off your display(s) with a single click (just click again to switch them back on).

3. SYSTEM SHORTCUTS
You can place a variety of shortcuts to various hard-to-find system tools and settings. Here, we've placed shortcuts to the Run command, Task Manager, and Game Controllers configuration dialog.

4. MEDIA PLAYER
Drag and drop compatible audio files (MP3, WMA or WAV) into the Media Player Settings window to create music playlists to listen to as you work.

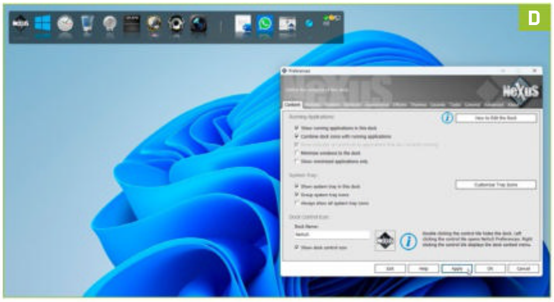
5. POWER SAVING MODE
This option will appeal to laptop users—quickly switch to power-saving mode with one click.

6. ALARM MANAGER
This lets you set up alarms that trigger reminders, run programs, or launch internal commands. You can set up a single alarm with the free version.

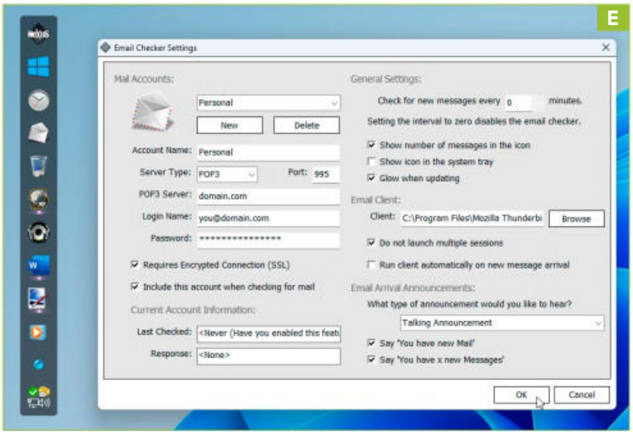
6 PIN SHORTCUTS

The main purpose of a taskbar is to make applications easy to open without cluttering up your desktop, and the same is true of Nexus. There's already a pinned shortcut to your default browser, but you'll want to pin your favorite apps to it. The process for doing so is the same for the Taskbar—if an app is open, right-click it and choose Pin to Dock. Its icon will move to the main section of the dock, but you'll lose any thumbnail preview it might have displayed. Roll your mouse over the icon, and you'll see a pop-up thumbnail, as is the case with the Taskbar.

» You can also drag folders and apps from the desktop or File Explorer on to the dock to create pinned shortcuts, or right-click and choose New Item to create a shortcut from scratch: choose your item type (Program by default, but Folder and URL are available), then fill in the form, clicking Find Item to select the program or folder you're pointing to, and Change Icon to find a suitable icon within another file (such as a DLL or the program's own EXE). When it comes to apps, however, the quickest route is to open the app and pin it directly from Nexus itself.



» After pinning a shortcut, right-click it in order to reveal a host of options that you won't find in Windows. Aside from giving you easy access to the program's parent folder (click 'Browse Container'), you can also select Opacity to make the program window semi-transparent, as well as keep it pinned on top of other windows.


E

Email Checker Settings

Mail Accounts:

Personal

New | Delete

Account Name: Personal

Server Type: POP3 Port: 995

POP3 Server: domain.com

Login Name: you@domain.com

Password: ***************

☑ Requires Encrypted Connection (SSL)

☑ Include this account when checking for mail

Current Account Information:

Last Checked: <Never (Have you enabled this feat

Response: <None>

General Settings:

Check for new messages every 0 minutes.

Setting the interval to zero disables the email checker.

☑ Show number of messages in the icon

☐ Show icon in the system tray

☑ Glow when updating

Email Client:

Client: C:\Program Files\Mozilla Thunderbi Browse

☑ Do not launch multiple sessions

☐ Run client automatically on new message arrival

Email Arrival Announcements:

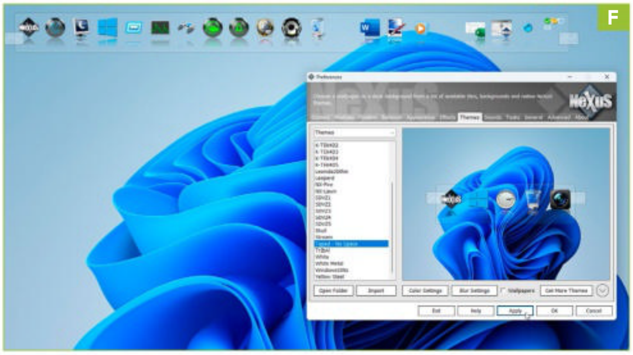
What type of announcement would you like to hear?

Talking Announcement

☑ Say 'You have new Mail'

☑ Say 'You have x new Messages'

OK | Cancel


F

7

CUSTOMIZE YOUR DOCK FURTHER

Time for the widgets. Most of the pre-built modules are included on the dock as standard, but right-click the dock and choose 'Insert New Dock Item > Module' to reveal several others: Email Checker alerts you to new mail from multiple POP3 and/or IMAP accounts (right-click it and choose 'Email Checker Settings' to configure it, as shown in [**Image E**]). There are also modules for monitoring network traffic, and Wanda, a fish that shows a pop-up quote on demand or at set intervals.

» Of potentially more interest is Nexus's support for 'Internal Commands'—the annotation reveals six highlights to look for, but there are dozens to choose from in into eight categories: Nexus, Desktop, Media, Disk, Misc, System, Settings, and Shut Down.

» As your collection grows, you may wish to introduce an extra layer of organization. One trick is to group related app icons together, then choose Separator from the New Dock Item menu to separate them from other icons. If you want to go further and are happy to pay, check the box on what additional organization tools are available in the WinStep Nexus Ultimate.

8

TRY A NEW SKIN

As with all good desktop apps, Nexus can be customized. Although several options—such as changing the dock's skin—are accessible when you right-click the Nexus dock icon, select Preferences to access the full range of options. Start by switching to the Themes tab to see what alternative skins are available. The default—Windows10Nx—sits comfortably within Windows 10 and 11, but there are 29 alternatives to choose from.

» Select one from the list for a preview, as shown in [**Image F**], then click Color Settings and Blur Settings to fine-tune it or check Wallpapers to see if the skin comes with its own background (Windows10Nx does). Click Apply to make changes or click 'Get More Themes' to explore various websites to find more themes. These can be added to Nexus via the Import button.

» Once you've selected your skin, explore the other tabs—Appearance lets you choose the size of your dock's tabs (48 by default. You can scale all the way up to 256, perfect for HiDPi screens, but less forgiving on apps with low-res icons), plus configure other effects, like the reflection of each app icon beneath it (50% by default). You can also set the dock's transparency and alter the spacing between icons from here.

» Switch to the Effects tab to make changes to the effects applied when certain actions occur, including mouse over and icon launch. Click < and > to choose a different effect, and 'Effect Settings' to fine-tune the effect. You can also apply other effects to the dock, like animated water ripples, whenever you click on it.

9

FINAL TWEAKS

The other tabs focus on configuring how Nexus behaves. You can force the dock to pin to the screen edge from the Position tab and make it appear on top of (or hidden behind) other windows. Switch to the Behavior tab to configure the dock's auto-hide settings and bypass the right mouse button so context menus pop up by rolling your mouse over an icon.

» The Tasks tab lets you configure how running apps behave. You can group windows from the same app together, and exclude specific apps or windows from appearing on the dock. Click Advanced to configure the thumbnail preview that pops up when rolling over an open app. Finally, explore the General tab to configure Nexus to start with Windows and make it effectively replace the taskbar by hiding the latter from view. ⏻

UPGRADE TO ULTIMATE

The free version of WinStep Nexus is perfectly usable, but if you find yourself needing extra layers of organization, consider upgrading to Nexus Ultimate. Nexus Ultimate doesn't simply support the use of multiple docks; it also provides alternative ways of organizing large collections of shortcuts, tools, and folders: Sub-docks for nesting related applications together, and Shelves, which work like tabbed docks. There's also a Drawers feature, which acts like a single tabbed Shelf.

Other benefits of upgrading include access to 1,000 high-quality bitmap icons for use in Nexus, additional widgets (including a calendar and battery monitor), and support for multiple alarms. You can customize the system tray with high-resolution icons, and there's a feature called Grid Stacks, which lets you access the contents of a folder from the dock. You can clear the desktop by displaying its icons via a Desktop tab when using Shelves.

Nexus Ultimate costs just $24.95, which is a lifetime license with free upgrades for 12 months after your purchase. After that, you can renew for another 12 months' worth of upgrades at any time for an additional $14.95. Visit www.winstep.net/buynow/nexus.asp for details.

Build a database with Data Crow

YOU'LL NEED THIS

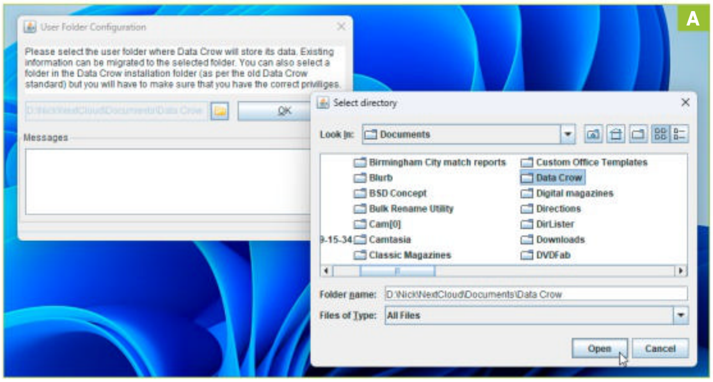
ONE OPEN SOURCE APP AND SOME MEDIA FILES TO CATALOG

Data Crow (https://datacrow.org/downloads)

IF YOU'RE LOOKING for a means to quickly build a database of your precious collections, then Data Crow is that tool. When we last featured it in early 2020, it was on life support and on the verge of falling into disrepair. Fast-forward to now, however, and not only has the original developer returned to the project, he has spent the last nine months updating and refining Data Crow so that it's better than ever.

Data Crow is designed to work with a wide range of collections, from books, music, and movies to newly added modules that allow you to organize your board games and comic books, too. You can input details of your items manually or make use of Data Crow's support for online databases, allowing you to input a name, find a match, and then quickly 'scrape' that database for information and artwork, just as you would with Plex or Kodi.

Once in place, you can search your database(s) for items, glean stats from them, and even set up a loan system, allowing you to lend items to friends and family without having to worry about tracking who has what. You can even create your own collections from scratch! Read on to discover how to get started. **–NICK PEERS**



Please select the user folder where Data Crow will store its data. Existing information can be migrated to the selected folder. You can also select a folder in the Data Crow installation folder (as per the old Data Crow standard) but you will have to make sure that you have the correct privileges.

Folder name: D:\Nick\NextCloud\Documents\Data Crow

1 START BUILDING YOUR COLLECTION

One of the benefits of Data Crow's resurrection is the fact that it's no longer dependent on an existing Java installation on your PC; instead, it bundles its own Java runtimes within the app directory itself. Now, all you need to do is head over to https://datacrow.org/downloads/ and click the 'Windows Installer 64bit' link to download it. Once done, extract the contents of the zip file, and double-click install.exe. When the Windows SmartScreen filter pops up, click 'More info', verify the publisher is NL, Friesland, Van der Waals B.V., Van der Waa ls B.V, and click 'Run anyway'.

» Run through the setup wizard, leaving the default choices selected. Once finished, click Done, and open Data Crow via its Start menu shortcut or a quick search for 'Data Crow'. You'll be prompted to select a folder where Data Crow will store its data—we recommend choosing somewhere in your Documents folder as shown in [**Image A**], making it easy to track, back up, and sync if necessary. Once done, Data Crow will complete setting itself up and automatically launch. Select your language when prompted, and click OK to go to the main screen.

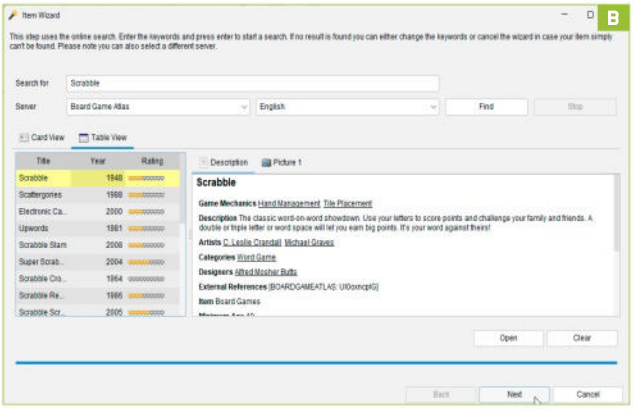
» Close the tip of the day dialog, and after the Tool Select wizard opens, pause until Data Crow pops up another dialog. This will offer to automatically check for—and download—new and updated online services. This ensures that as the underlying APIs are updated, Data Crow is able to continue grabbing descriptions and artwork from supported websites, so click Yes when prompted.

» The Tool Select wizard will display all available pre-built modules—clicking one merely displays it on the main screen. Click Next for a quick rundown of key commands, and then click Finish to close the wizard.

2 SEARCH ONLINE CATALOGS

You'll see that each collection type has its own icon beneath the menu bar—click one to switch to it. Most cover a single subject, but the Media Items (globe icon) module lets you manage all media-based collections from a single view. Whichever option you choose, click the New Item Wizard button beneath the collection icons or choose 'File > Item Wizard' to add your first item.

» If you've selected the Media collection, you'll be prompted to choose a module from the eight media types supported—otherwise, you'll be taken to Data Crow's online search tool. Start by typing all or part of the item's title into the 'Search for' box and click Find. Some online services—such as Comic Vine—require you to register for a free account. This gives you access to your own personal API key to allow you to download information



This step uses the online search. Enter the keywords and press enter to start a search. If no result is found you can either change the keywords or cancel the wizard in case your item simply can't be found. Please note you can also select a different server.

Search for: Scrabble

Server: Board Game Atlas | English

Title	Year
Scrabble	1948
Scattergories	1988
Electronic Ca...	2000
Upwords	1981
Scrabble Slam	2008
Super Scrab...	2004
Scrabble Cro...	1964
Scrabble Re...	1986
Scrabble Scr...	2005

Scrabble

Game Mechanics Hand Management Tile Placement

Description The classic word-on-word showdown. Use your letters to score points and challenge your family and friends. A double or triple letter or word space will let you earn big points. It's your word against theirs!

Artists C. Leslie Crandall Michael Graves

Categories Word Game

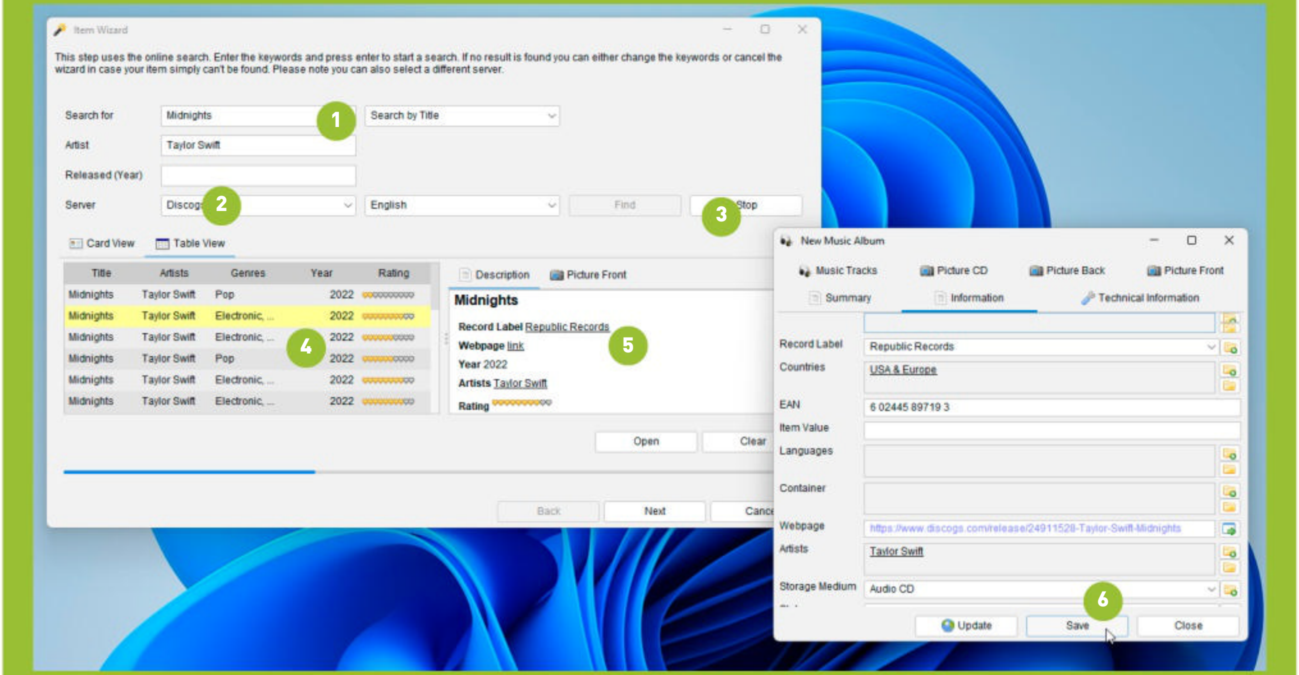
Designers Alfred Mosher Butts

External References [BOARDGAMEATLAS: Ul0oxncplG]

Item Board Games

© DATA CROW

FIND ITEMS ONLINE



Item Wizard

This step uses the online search. Enter the keywords and press enter to start a search. If no result is found you can either change the keywords or cancel the wizard in case your item simply can't be found. Please note you can also select a different server.

Search for: Midnights — Search by Title

Artist: Taylor Swift

Released (Year):

Server: Discogs — English

Title	Artists	Genres	Year	Rating
Midnights	Taylor Swift	Pop	2022	
Midnights	Taylor Swift	Electronic, ...	2022	
Midnights	Taylor Swift	Electronic, ...	2022	
Midnights	Taylor Swift	Pop	2022	
Midnights	Taylor Swift	Electronic, ...	2022	
Midnights	Taylor Swift	Electronic, ...	2022	

Midnights

Record Label Republic Records

Webpage link

Year 2022

Artists Taylor Swift

Rating

New Music Album

Record Label: Republic Records

Countries: USA & Europe

EAN: 6 02445 89719 3

Item Value:

Languages:

Container:

Webpage: https://www.discogs.com/release/24911528-Taylor-Swift-Midnights

Artists: Taylor Swift

Storage Medium: Audio CD

1. SEARCH TERMS
Most online databases restrict you to a single keyword search, but some—like the Discogs music search tool—allow you to search using multiple criteria to create more filtered searches.

2. PICK A SEARCH PROVIDER
Several modules—including Books, Movies, and Music—offer a choice of different search engines to try. Compare results to see which offers the best fit.

3. RESTART
Click Find to search using your criteria. If you've found what you're looking for or want to edit your terms, click Stop before making changes.

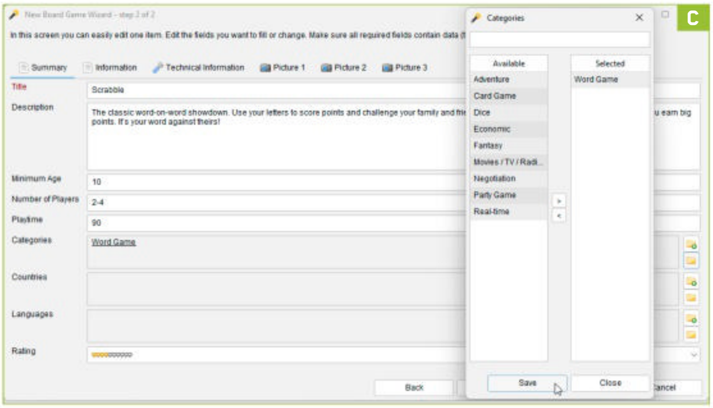
4. BROWSE RESULTS
Card View effectively lets you comb through the results using their artwork to help steer you to a possible match. Switch to Table View to view multiple results at once.

5. VIEW DETAILS
If you have multiple matches to choose from, you'll need to get a more detailed view: click an entry, and use these tabs to see if it's a match.

6. GET A DETAILED VIEW
Click Open to view everything the online provider has on the album. If it's a definite match, click Save to download the details now, then start a fresh search from the Item Wizard screen.

from the service in question—follow the instructions to do so. Once done, click the Settings button next to the service's name to input or paste in the key, then repeat your search.

» You should see the Find button gray out while the search is performed—after a short pause, Data Crow will start to display any matches in the Card View window, as shown in [**Image B**].



C

New Board Game Wizard - step 2 of 2

In this screen you can easily edit one item. Edit the fields you want to fill or change. Make sure all required fields contain data (t

Title: Scrabble

Description: The classic word-on-word showdown. Use your letters to score points and challenge your family and fri … u earn big points. It's your word against theirs!

Minimum Age: 10

Number of Players: 2-4

Playtime: 90

Categories: Word Game

Countries:

Languages:

Rating:

Categories

Available	Selected
Adventure	Word Game
Card Game	
Dice	
Economic	
Fantasy	
Movies / TV / Radi...	
Negotiation	
Party Game	
Real-time	

© MICROSOFT

If more matches are found—say, for multiple movies in a series, or for variants of popular board games like Monopoly or Scrabble—then you'll see a blue progress bar advance across the bottom of the search window.

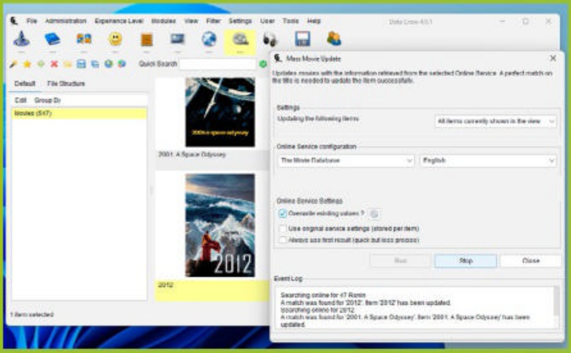
» The Card View window shows items by thumbnail only—either use the scrollbar to go through the results or switch to the Table View tab to display a list that includes additional details like year or rating to help differentiate between matches. Click an item, and a full description will appear in the right-hand pane, helping you confirm the match.

3 ADD ITEMS TO YOUR COLLECTION

The description provides all the information that will appear in your collection—click Next, and you'll get a detailed view of everything that will be added, spread across six tabs. If necessary, resize the window for a more comfortable view. You'll find that all fields are editable, allowing you to add extra or missing information, or make changes to existing data.

» Each field contains different types of information, just as in a database—some allow you to simply type

SPEED UP DATA ENTRY


Data Crow 4.0.1
File Administration Experience Level Modules View Filter Settings User Tools Help
Quick Search
Default File Structure
Edit Group By
Movies (5X7)
2001: A Space Odyssey
2012
1 item selected
Mass Movie Update
Run
Stop
Close

Updates movies with the information retrieved from the selected Online Service. A perfect match on the title is needed to update the item successfully.

Settings
Updating the following items: All items currently shown in the view

Online Service configuration
The Movie Database
English

Online Service Settings
☑ Overwrite existing values ?
☐ Use original service settings (stored per item)
☐ Always use first result (quick but less precise)

Event Log
```
Searching online for 47 Ronin
A match was found for '2012'. Item '2012' has been updated.
Searching online for 2012
A match was found for '2001: A Space Odyssey'. Item '2001: A Space Odyssey' has been updated.
```

While the Item Wizard is undoubtedly a convenient way to add items to your collection, there are several ways in which you can speed up the process. If you click the globe icon to the left of the chart button, you'll open an alternative search box—one that gives you greater control over the process, and which allows you to add items with a single click. Simply enter your search terms in the usual way, select your game from the list, and click Add Item(s)—as the name implies, if the search results include two or more items from your collection, you can speed things up even further by holding Ctrl as you click on each one to select them before clicking Add Items(s).

You can also import items—say, a list of movie titles—from another file, such as a spreadsheet. Simply export the file in CSV format, then choose Tools > Item Import Wizard. Select your target module followed by file type (XML or CSV). After selecting the file, you'll be prompted to map your fields from Source (in the file) to Target (in Data Crow). Click Next and wait for the items to be imported. When done, click OK, then choose Tools > Mass <Module> Update to scrape the online database to flesh out their details.

text, while others have one or more folder icons next to them, indicating that they contain data from a related sub-module (such as actors, designers, or genre). A folder with a + symbol allows you to create a new entry from scratch, while the other folder symbol lets you pick an existing entry as shown in [**Image C**]. Remember, you can edit your catalog items later on, so if you're in a hurry, consider skipping this step and returning to it later.

» You can also add your own images or edit existing ones via the Picture tabs on offer: there are tools to rotate, sharpen, blur, or convert to grayscale, plus you can add your own from a file, web URL, or 'memory' (the clipboard). Up to three pictures can be added depending on the module type, allowing you to add—for example—the back and front covers of a DVD slipcase.

» When you're happy with your changes, click Finish to close the wizard, or Finish & New to add more entries.

4 WIDEN YOUR SEARCH

If your online search doesn't find any matches, click the Server dropdown menu to see if the module offers more than one search engine to use—some, like Comic Books and Board Games, only support a single search provider, but others, like Books and Movies, give you a choice of providers—for example, Books allows you to switch between Google Books, Open Library, and Archive.org. You can mix and match items from different online providers, so don't feel obliged to stick to just one—you might even want to compare the results from each to see which one provides you with the best information.

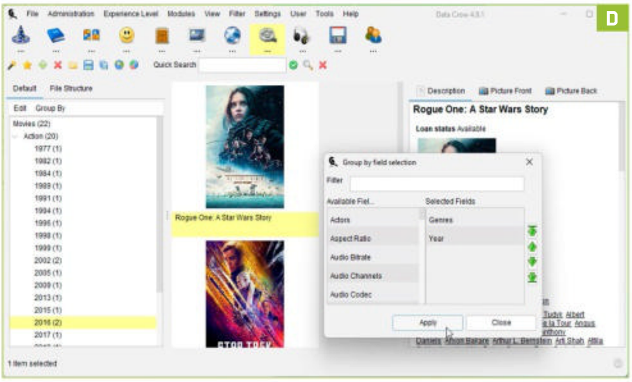
» If you're still unable to find any matches, and you've tried various keyword combinations with no success, close the wizard and click the + button to fill in the required fields and attach images yourself. Yes, it's a slower process, but you're in full control of what information is recorded, and you'll hopefully only have to resort to this method for a handful of rare items into your collection. Once done, click the New Item Wizard or consult the 'Speed up data entry' box for more time-saving tips.

5 BROWSE YOUR COLLECTION

As you add items to your collection(s), you will want to review what you've recorded. The main Data Crow window displays your collection across three panes: on the left is a File Explorer-like navigation pane where—if supported—your collection can be grouped into categories. All items in the currently selected category are then displayed in card view in the middle pane—press F2 to switch to table view, and F3 to switch back again. Select an item from here, and you can review it in the right-hand pane, where you'll see a summary of the information you added or downloaded from the internet, along with an option to view one or more pictures.

» The navigation pane can appear quite basic, offering you a single view of everything in that collection. Click 'Group By' and choose 'Select Fields' to open the 'Group by field selection' to allow you to add another layer of navigation. First, resize the dialog, as it can be a little cramped, and you'll see that it shows two columns: Available Fields and Selected Fields. Double-click an entry in Available Fields to add it to Selected Fields, then click Apply. You'll see you can now browse by whatever field you selected. You can add multiple fields to create extra layers of navigation, as shown in [**Image D**].

» When it comes to displaying matching items in the middle pane, you'll see they're sorted alphabetically by default. You can change this by right-clicking anywhere inside the pane and choosing Sort. Again, resize the Sort box to reveal a list of all that module's fields. Simply double-click an entry under Available Fields to add it to the Selected Fields column. Repeat for any other fields, then use the arrow buttons to change the order in which the sort is applied (such as year followed by title). Choose


D
Data Crow 4.0.1
File Administration Experience Level Modules View Filter Settings User Tools Help
Quick Search
Default File Structure
Edit Group By
Movies (22)
Action (20)
1977 (1)
1982 (1)
1984 (1)
1989 (1)
1991 (1)
1994 (1)
1996 (1)
1998 (1)
1999 (1)
2002 (2)
2005 (1)
2009 (1)
2013 (1)
2015 (1)
2016 (2)
2017 (1)
Rogue One: A Star Wars Story
Description
Picture Front
Picture Back
1 item selected
Group by field selection
Filter
Apply
Close

Rogue One: A Star Wars Story
Loan status Available

Available Fiel...: Actors, Aspect Ratio, Audio Bitrate, Audio Channels, Audio Codec
Selected Fields: Genres, Year

© DATA CROW

your sort order (ascending or descending), and click Apply to see the results.

6 MORE DISPLAY OPTIONS

Once your collection grows beyond a certain point, browsing all of it at once may become increasingly unwieldy. Data Crow offers several ways in which you can change what's shown—there's the navigation pane of course, but you'll also see the Quick search tool, which lets you create a quick and dirty keyword filter that searches titles only.

» If you'd like to build a more complex filter across all the fields in your collection, click the magnifying glass next to the Quick Search box or choose 'Filter > Filter'. Here, you define one or more conditions using modules, fields, operator (is filled, is empty, contains, or does not contain) and a value. Click Add after defining each one. Review your filter by clicking Apply, then reopen the dialog to continue adding more conditions, define the sort order via the Sort tab, or save frequently used filters for easy retrieval via the Maintain tab.

» In this way, filters don't simply allow you to show a subset of your collections; you can also use them to identify items that may be missing information (say, using the 'is empty' operator in connection with certain fields), allowing you to rectify the situation.

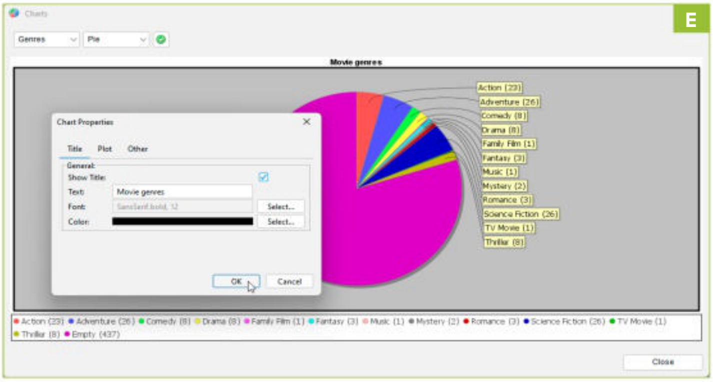
» Fancy getting a graphical overview of your collection? Click the chart button to open a new window from where you can generate a pie or bar chart based on whichever field you like. Once generated, right-click the chart to copy, save (as a PNG) or print the chart, or tweak its appearance by choosing Properties, as shown in [**Image E**].

7 OPERATE A LENDING LIBRARY

Data Crow offers tools for administering loans of your items to friends, family, and acquaintances, helping you keep track of who's got what, how long they've had it, and—if applicable—when they're due to return it.

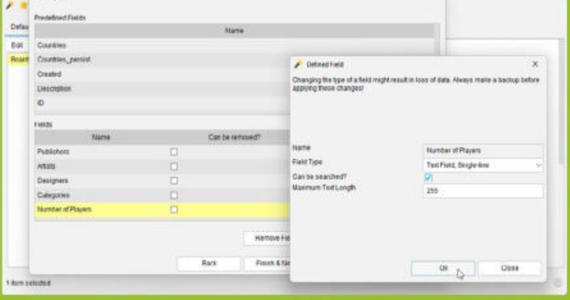
» The library works in tandem with the Contacts module, which is where you can store all kinds of contact information about people, from their name and email address to phone and address details. The information can be entered manually, or you can input it from an XML or CSV file created elsewhere—to do this, go to Tools > Item Import Wizard. It works in the same way as described in the 'Speed up data entry' box, although we recommend you clean up the exported CSV file in Excel or a similar spreadsheet to remove irrelevant fields before attempting to import it into Data Crow.

» Once set up, you can then choose Tools > iCalendar Loan Export to export the details into a file you can then import into your main calendar so you don't forget to chase up overdue items.


E

General:
Show Title: ☑
Text: Movie genres
Font: SansSerif.bold, 12

CUSTOMIZE MODULES



The module has been defined. Now you can add the fields to the module. Press "add" to create a new field and "remove" to remove an existing field.

Predefined Fields

Name
Countries
Countries_persist
Created
Description
ID

Fields

Name	Can be removed?
Publishers	☐
Artists	☐
Designers	☐
Categories	☐
Number of Players	☐

Changing the type of a field might result in loss of data. Always make a backup before applying these changes!

Name: Number of Players
Field Type: Text Field, Single-line
Can be searched? ☑
Maximum Text Length: 255

Data Crow is all about customizability, so if there's anything wrong with the modules on offer, you can change them—or go the whole hog and build your own from scratch. Everything you need can be found on the Modules menu—there are wizards to step you through the process of creating new modules from scratch or using an existing module as a template ('Copy Module Wizard'), plus wizards for altering existing modules and grouping related modules together.

Let's focus on amending an existing module: choose 'Modules > Alter Module Wizard'. Select the module you wish to modify (you'll see there are lots of sub-modules available for editing too—these are related to parent modules, like Actors for Movies, or Designer for Board Games). Step one of the wizard lets you rewrite the module's description and change the icons (Google 'free icons' to find lots of free examples online—choose PNG or GIF format to preserve transparent backgrounds), while step two allows you to add, modify, and remove fields as required. Once done, click Finish.

You can also quickly edit the currently selected module's field properties by selecting 'Settings > General Field Settings', where you'll find options to define custom labels, as well as determine if the field is visible, required, or descriptive.

8 ACCESS DATA CROW ON MULTIPLE DEVICES

So far, we've used Data Crow on a single PC, but what if you wanted access across a range of devices on your network? In the past, we've recommended installing the Data Crow server component (https://datacrow.org/docs/data-crow-server/), but after a lot of struggling with getting the server set up, we're not convinced it's ready for prime time. Ideally, the developer will release a docker container version that would simplify setup and get things working flawlessly.

» Instead, we recommend keeping your Data Crow data folder synced across all the computers you need access from—say, using Google Drive, OneDrive, or NextCloud. After installing Data Crow on a second PC or Mac, point it towards the synchronized Data Crow data folder, and you can update your collections on both computers.

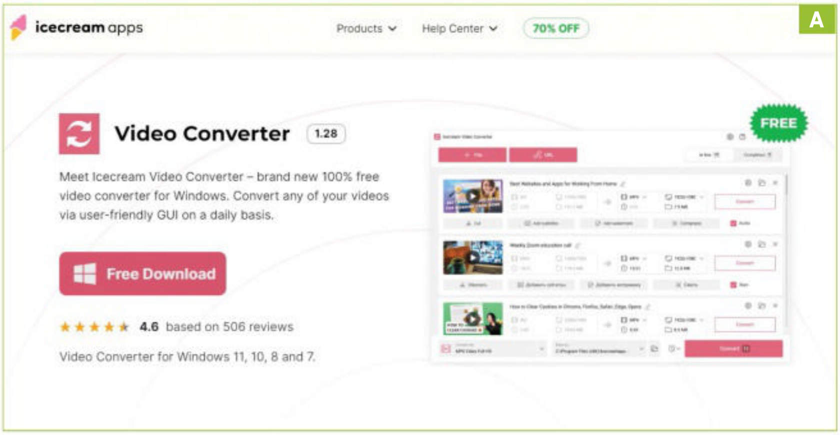
» A word of warning: never open Data Crow on both machines simultaneously—close one and let the changes sync before opening it on your other device. ⏻

Convert videos easily with presets

YOU'LL NEED THIS

ICECREAM VIDEO CONVERTER 1.28
And 20 spare minutes

IF YOU'RE FED UP with attempting to play video files on your smart TV, tablet, or phone, only to find that the video format isn't compatible with your device, then you should try Icecream Video Converter. This free tool converts video files from one format to another, and its latest version (1.28) adds handy presets that ensure your converted videos can play on specific devices, including iPhones, iPads, and certain brands of smart TV. Here, we explain how to use the program to convert, trim and add watermarks to your video files. **–NICK PEERS**


A
icecream apps
Products
Help Center
70% OFF
FREE
Video Converter
1.28
Free Download

Meet Icecream Video Converter – brand new 100% free video converter for Windows. Convert any of your videos via user-friendly GUI on a daily basis.

★★★★★ 4.6 based on 506 reviews

Video Converter for Windows 11, 10, 8 and 7.

1 DOWNLOAD AND GET STARTED

Visit www.icecreamapps.com/Video-Converter/ and click the Free Download button. Your download should start automatically, depending on the browser you're using [**Image A**]. In Edge, you'll need to click the 'Save as' button in the box that pops up, and choose where to download the file to. Double click the 'video_converter_setup.exe' file and follow the installation instructions until the process is complete. Launch the program—if you see an error message saying MSVCP120.dll was not found, you'll need to install Microsoft Visual Studio 2013 (VC++ 12.0) from https://tinyurl.com/8zar259m. Make sure you download the correct version for your system (X64 for 64bit, X86 for 32bit). Reboot your PC.

2 CHOOSE YOUR FILES

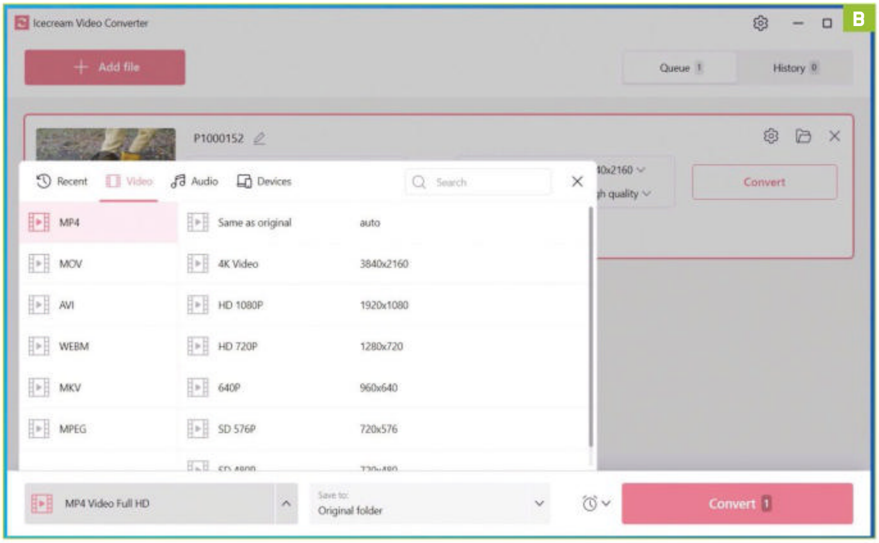
In Icecream Video Converter, you can add video files you want to convert by clicking the '+ Add file' button and browsing for the files you want, or by dragging and dropping them from a File Explorer window [**Image B**]. To quickly convert to a different file type, ignore all other options (Trim, Subtitles, and so on), and click the arrow next to the output file type option in the bottom left—by default, this will say MP4 Video Full HD. Select the file type you need (MP4, MOV or AVI, for example) on the left, then select 'Same as original', and click the Convert button.

3 SELECT YOUR DEVICE

If you don't know exactly what file type you need, you can let Icecream Video Converter decide this for you by using a preset based on the device you want to play the file on. Add your video file as described in Step 2, then click the arrow next to MP4 Video Full HD in the bottom left [**Image C**]. Click the Devices tab at the top of the panel that opens, select your device manufacturer on the left—Samsung, for example—then click the device type in the list on the right. Click the Convert button once you're ready.

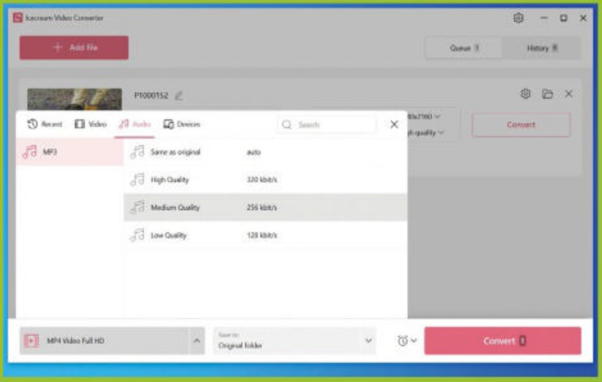
4 TWEAK THOSE SETTINGS

You can change your conversion settings manually by selecting individual options for each clip. Add a file, and you'll see its original file format, resolution, and more in a small box to the right of the clip's thumbnail image. To the right of that, you'll see another box with the currently selected conversion settings. [**Image D**] You can click the down arrow next to any of these, and select an alternative. For example, you could click the 'Low quality' option if you wanted to save storage space. You can also remove the sound from your converted video by unticking the Audio box.


B
Icecream Video Converter
+ Add file
Queue 1
History 0
P1000152
Recent
Video
Audio
Devices
Search
MP4
MOV
AVI
WEBM
MKV
MPEG
Same as original auto
4K Video 3840x2160
HD 1080P 1920x1080
HD 720P 1280x720
640P 960x640
SD 576P 720x576
SD 480P 720x480
Convert
MP4 Video Full HD
Save to: Original folder
Convert 1

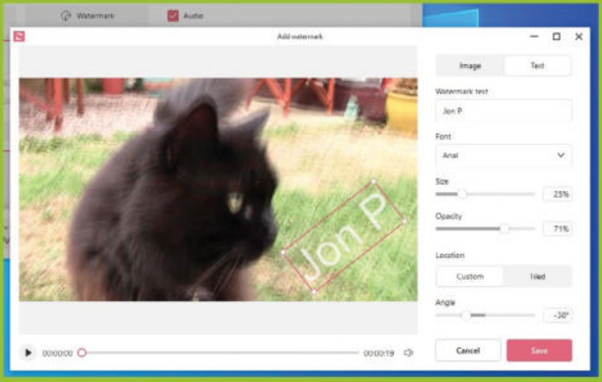
© ICECREAM VIDEO CONVERTER

OPTIONAL EXTRAS


Icecream Video Converter
Add file
Queue 1
History 8
P1000152
Recent
Video
Audio
Devices
Search
MP3
Same as original auto
High Quality 320 kbit/s
Medium Quality 256 kbit/s
Low Quality 128 kbit/s
Convert
MP4 Video Full HD
Save to: Original folder
Convert 1

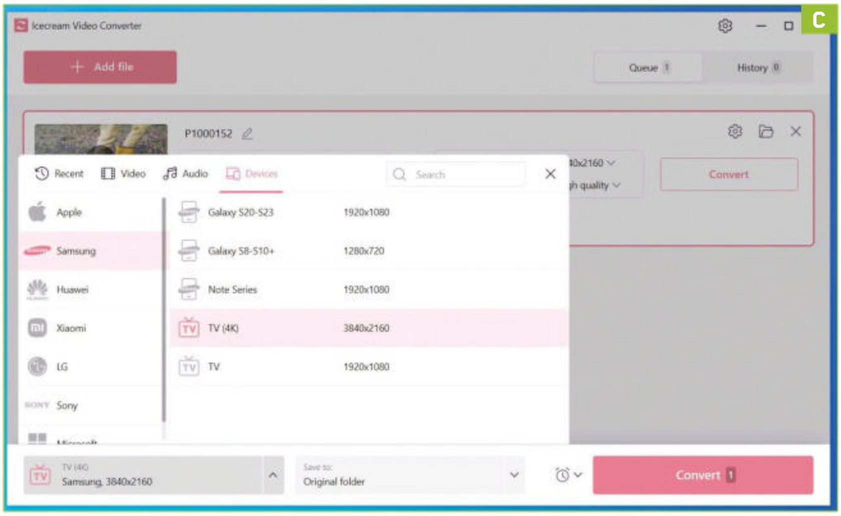
EXTRACT AUDIO

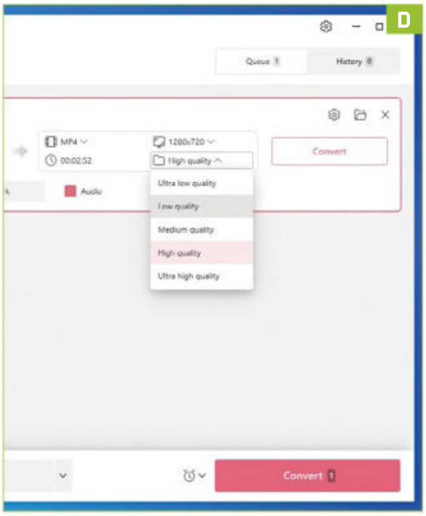
You can use Icecream Video Converter's presets to extract audio from a video file. Let's say you have a video of a friend or relative playing in a band and you wanted to create an MP3 of the music—you can do this by adding the clip as described in Step 2, then clicking the arrow next to MP4 Video Full HD in the bottom left. Now, click the Audio tab at the top of the panel that opens, and select the quality setting you want for your MP3 audio file from the options. Click the Convert button when you're ready.


Watermark
Audio
Add watermark
Image
Text
Watermark text
Jon P
Font
Arial
Size
25%
Opacity
71%
Location
Custom
Tiled
Angle
-30°
Jon P
00:00:00
00:00:19
Cancel
Save

WATERMARK YOUR VIDEO

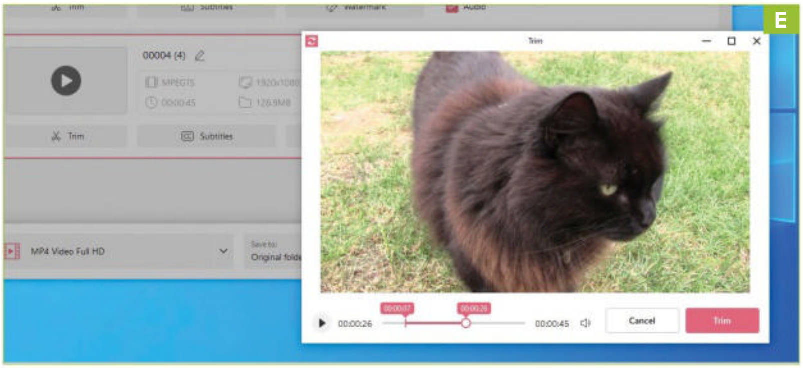
If you want to prevent others from copying or distributing your video file, you can add a watermark, such as your name. Click the Watermark button below the video thumbnail of your clip. In the window that opens, click the Text button in the top right, then type your name in the box under 'Watermark text'. You can customize other settings, such as Font, Size, and Opacity, below. You can also change the watermark's position by clicking it in the preview window and dragging it to where you want it. Once you're happy, click Save.


C
Icecream Video Converter
Add file
Queue 1
History 0
P1000152
Recent
Video
Audio
Devices
Search
Apple
Samsung
Huawei
Xiaomi
LG
Sony
Microsoft
Galaxy S20-S23 1920x1080
Galaxy S8-S10+ 1280x720
Note Series 1920x1080
TV (4K) 3840x2160
TV 1920x1080
3840x2160
High quality
Convert
TV (4K)
Samsung, 3840x2160
Save to:
Original folder
Convert 1


D
Queue 1
History 0
MP4
00:02:52
1280x720
High quality
Convert
Audio
Ultra low quality
Low quality
Medium quality
High quality
Ultra high quality
Convert 1

5 TRIM THEN CONVERT

Icecream Video Converter offers some useful options for fine-tuning your converted videos. For example, you may only want to convert a short section of a longer clip. You can do this by clicking the Trim button below the video thumbnail of a clip you've added, after which a new window will open. Here, you can drag the left-hand timecode marker on the timeline below the preview image to where you want your clip to start. [**Image E**] Now, drag the right-hand timecode marker to where you want the clip to stop. Once you've set your start and end points, click the Trim button. ⏻


E
Trim
Subtitles
Watermark
Audio
00004 (4)
MPEG-TS
00:00:45
1920x1080
126.9MB
MP4 Video Full HD
Save to:
Original folder
00:00:07
00:00:26
00:00:26
00:00:45
Cancel
Trim

LAB NOTES

JEREMY LAIRD, CONTRIBUTOR

The handheld PC bubble is fit to burst

The Steam Deck's dubious legacy

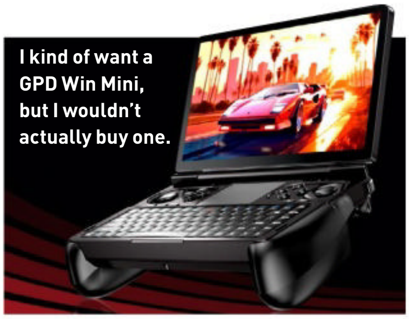
VALVE'S STEAM DECK is one of those devices that somehow adds up to more than the sum of its parts. Its custom AMD APU is looking pretty elderly, especially since AMD rolled out the new Phoenix chip with far better graphics performance. But of all the burgeoning arm of handheld gaming PCs, the Deck remains the one to buy.

The reasons why have been discussed ad infinitum, so I'm not going to rehash them. You know the drill, it's about things like long-term support, game validation, a vibrant ecosystem, a critical mass of users, and how all of that outweighs performance or a slightly substandard screen.

Instead, what's more interesting is to ask who is going to buy all of the new handhelds that seem to appear on an almost daily basis. There are so many of them offered by everyone from big brands like ASUS through to hitherto unknown startups, the whole enterprise is beginning to look like a bubble that's fit to burst.

Of course, it's difficult to say how well many of these devices sell. There have been reports that the ASUS RoG Ally handheld has been particularly hard to shift, despite far better performance than the Steam Deck and pricing that was much more reasonable than many had feared, but I can't say how accurate that is.

Still, as I perused the upcoming GPD Win Mini, a clamshell handheld that resembles a tiny seven-inch laptop and houses that AMD Phoenix chip, I found myself in cognitive dissonance. On the one hand, I thought it looked pretty cool and wondered whether it could actually be a viable replacement for a laptop. On the other, I already knew it couldn't, and likewise knew that despite it looking pretty funky, I'd never buy one, and I couldn't see many others disagreeing.



I kind of want a GPD Win Mini, but I wouldn't actually buy one.

These things only really work when they're cheap enough to be bought as an almost impulse purchase for about $350 to $400 or so, again like the entry-level Deck. Once you get up to $700 or $800, expectations scale with the price, and you might reasonably demand something that can indeed replace a gaming laptop. But like I said, the GPD Win Mini and its brethren just aren't going to do that.

SAM LEWIS

Staff writer

Aside from PCs and music, graphic design is another passion of mine. I even used to work as a graphic designer before diving into the world of tech journalism. Although I don't do it professionally anymore, I still like to create on the side for friends and family. I also like to sketch using a graphics tablet in my free time as a stress reliever and to wind down after work.

Don't get me wrong, I'm hardly the next Picasso—I just enjoy it! However, when time is tight and I need to add some more accurate/professional illustrations or infographics to my work, there is a quick easy solution I like to use called unDraw.

This website hosts a range of open-source illustrations for you to use. You can use these in any project and also commercially without any contributions. Trust me, that makes life a lot easier!

On the illustrations page in the top right, you can select an exact color swatch, and this acts as the main color throughout the illustrations on the page. There's also a search bar and best of all, you don't even need an account to start downloading the PNG/SVG files.

If you're into design work or just want to spice up your slideshows, for example, check out undraw.co.

© VALVE

Brand new LG monitor, same old OLED panel problems.

Editor's Pick:

LG UltraGear 45GR95QE

Can this OLED gaming monitor rise above?

ANOTHER DAY, another uber-sized OLED gaming monitor. It's an occupational hazard in this game to become blasé about $1,000-plus OLED panels. Enter the new LG UltraGear 45GR95QE, which arrives with plenty of baggage.

I say that because personally I've yet to see an OLED gaming monitor with an LG panel that's any good. Whatever the brand of OLED monitor, it'll either have one of LG's WOLED panels (where the "W" refers to a white subpixel designed to increase brightness) or Samsung's QD-OLED tech.

Of course, the part of LG that makes monitors is far removed within the LG empire from the bit that makes OLED panels, but the LG branding robs this monitor of mystery. I was confident of what to expect, and the huge 45-inch LG UltraGear 45GR95QE didn't disappoint—or it did, but in entirely predictable ways.

The thing about LG OLED panels is they're not all that for full-screen brightness. They're great for, say, lighting up small, bright objects on a dark background. A star field in a sci-fi film is the obvious example. In that context, this class of LG panel can hit 1,000 nits or more for tiny pinpoints of light, all while maintaining perfect per-pixel control. A mini-LED backlight with a few thousand dimming zones at best doesn't come close.

But when you want to light up the whole screen, you have a problem. Admittedly, that doesn't happen all that much in movies and TV, which is why LG OLED panels have a decent reputation in the TV market. But back on the PC, all you have to do is open up a browser window with a white background to be in no doubt about this LG monitor's limitation.

In short, the brightness dims dramatically. You can dial that out by disabling the ABL (automatic brightness limiter), which is what adjusts brightness depending on what proportion of the panel is lit up. But that just keeps the panel at the lower brightness level all the time.

You have the choice of leaving the ABL on and seeing the brightness jump about depending on what you have on screen, or turning it off and having a dingy display south of 200 nits of brightness. Either way, it's a poor return for roughly $1,300.

Samsung's QD-OLED panels are better in that regard. As it happens, I've also just been taking a look at the new Samsung Odyssey OLED G9, the 49-inch 32:9 aspect monster. It doesn't suffer from any of that ABL nonsense, and never looks less than punchy. The slight snag is that there are arguably more long-term concerns over burn-in and image retention on Samsung's QD-OLED panels than LG's WOLED tech.

There's some debate over how the two panel techs compare in that regard, but there's enough evidence that if I had to put money on one of the two showing signs of burn-in first, it would be QD-OLED.

Anyway, I could also tell you how well the LG UltraGear 45GR95QE handles SDR content in HDR mode in terms of color balance or how the matte anti-glare coating detracts from perceived contrast. There's also the broader discussion about resolution and pixel density. This is a large 45-inch display, and the 3,440 by 1,440 native res doesn't cut it when it comes to image sharpness on the desktop.

But it's a bit academic in the context of this screen's basic brightness borkage. I wouldn't want to put up with it on a $100 budget monitor I'd bought on Alibaba. But at this elevated price point, forget it. **–SW**

$1,299, www.lg.com

© LG, START 11, GEARBOX PUBLISHING

Reviewed...

74 MSI RTX 4060 Ventus Black 2X OC

76 Corsair Xeneon 27QHD240

78 Acer Predator Helios 16

80 Lenovo Legion Tower 5i

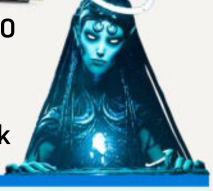
82 Alienware M16

84 Elgato Wave DX

87 Logitech Pro X 2 Lightspeed

88 Corsair TC100 Relaxed

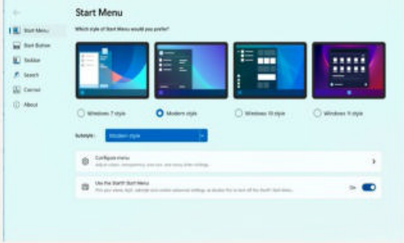
790
Lexar
NM790



89 Lexar NM790

90 Remnant 2

92 Start 11 vs StartAllBack



Nvidia's new RTX 4060 is really an RTX 4050 by another name.

MSI RTX 4060 Ventus Black 2X OC

A graphics card with the wrong name

NVIDIA'S RTX 40-series is almost complete. Apart from a probable RTX 4050 and potential RTX 4090 Ti, this GeForce RTX 4060 is shaping up to be one of the final RTX 40-series offerings. It's a major release—as the de facto mass-market Ada Lovelace GPU—and an important piece of the larger PC gaming puzzle. Should the RTX 4060 be a good performer, it has the potential to drive a wave of upgrades.

But that's the thing—it needs to be a good performer. At $299, Nvidia is positioning the RTX 4060 as a capable 1080p card, which is already a little problematic given you can now buy a decent high-refresh 1440p monitor for around $200. But with no RTX 4060 Founders Edition, we have MSI's RTX 4060 Ventus Black 2X OC for review.

It's a solidly built card with dual fans, a full-length backplate, and a discrete all-black design, and features an utterly inconsequential factory overclock of 30MHz over the base RTX 4060 specification. Oh, and it runs an 8-pin power connector. That's a smart choice, as the 12VHPWR connector common to RTX 40-series cards is complete overkill, and most potential RTX 4060 buyers are going to have more modest power supplies without 12HPWR connectors anyway.

Getting back to the RTX 4060, it's built around the AD107 GPU and comes with 24 Streaming Multiprocessors (SMs), giving it 3072 CUDA cores, 24 RT cores, and 96 Tensor cores. These counts are actually lower than those of the last-gen RTX 3060 12GB, which is the first hint that there's something up with this new 4060. Since when did new GPUs have fewer shaders than the graphics chips they replace?

Then there's the 8GB of VRAM. It's hardly a surprise, given the higher-spec RTX 4060 Ti also runs 8GB of graphics memory, and yet it's still less than the 12GB the RTX 3060 had. Nvidia would argue 8GB is fine for the 1080p remit, but 8GB is going to be an issue already for some modern games, and it's only going to get more limiting as this GPU ages.

Anyway, the RTX 4060 is certainly most comfortable at 1080p. In the games we tested, with the exception of *Cyberpunk 2077*, the RTX 4060 is capable of the all-important 60 fps or higher, and that's without enabling Nvidia's DLSS scaling tech, including frame generation. To that extent, it's job done.

Step things up to 1440p, and the RTX 4060 is a mixed bag. *Cyberpunk* crashes to 20 fps, while a few other titles are in the 30 to 40 fps range. As for how it compares to AMD's cheaper Radeon RX 7600, in conventional raster-based games—which is most games, to be frank—there's not much in it. With ray tracing, the Nvidia GPU has the lead. It's also worth noting that at 1440p, the 4060 is barely 10 to 15 percent faster than the old 3060.

All of this explains why Nvidia is keen to push DLSS scaling technologies as a selling point. Take *Cyberpunk*. Without DLSS at 1080p, you're looking at 34 fps. With DLSS scaling set to quality, that jumps to 63 fps. Enable frame generation, and you're looking at 98 fps.

Granted, DLSS doesn't work as well at lower resolutions like 1080p as it does at, say, 4K. Frame generation adds latency, but the numbers are so impressive that it makes for a useful sales pitch.

If we were comparing the RTX 4060 8GB to the RTX 3050 8GB that launched at $249, then the RTX 4060 would be viewed in a different light, representing a generational upgrade and a solid buy. As it is, Nvidia is taking what should be the RTX 4050 and not only calling it the RTX 4060, but also pricing it as one. That isn't going to fool anyone. **–CHRIS SZEWCZYK**

VERDICT

6

MSI RTX 4060 Ventus Black 2X OC

⊕ WHAT A BARGAIN Very efficient; Strong DLSS feature set.

⊖ FALSE ECONOMY Barely any better than a 3060; Only 8GB VRAM.

$299, www.msi.com

BENCHMARKS

	MSI RTX 4060 Ventus Black 2X OC	Nvidia RTX 4060 Ti	Nvidia RTX 3060 Ti
Cyberpunk 2077 RTX (fps)	34	**44**	37
F1 22 RTX (fps)	66	**83**	70
Far Cry 6 RTX (fps)	101	**106**	105
Metro Exodus Enhanced (fps)	72	**91**	77
Red Dead Redemption 2 (fps)	81	**102**	92
Total War: Warhammer III (fps)	83	**105**	97

Best scores are in bold. Our test bench consists of an Intel Core i9 12900K, Asus ROG Z690 Maximus Hero, 32GB DDR5-56600 RAM, 1TB WD Black SN850 and Windows 11 22H2. All tests were conducted at 1080p at maximum settings.

SPECIFICATIONS

GPU	AD107
Lithography	TSMC 4N
CUDA cores	3072
Boost clock	2,460 MHz
Memory	8GB GDDR6
Memory interface	128-bit
Die size	187.8mm²
Transistors	22.9B
TGP	115W

Corsair Xeneon 27QHD240

As good as 1440p gets, but at a price

YOU CAN BUY OLED PC monitors from a growing list of brands. Ultimately, however, the actual OLED panels that go into those screens are sourced from just two companies: LG and Samsung. It's the former that provides the 27-inch OLED panel in the new Corsair Xeneon 27QHD240. Unfortunately, that's an issue.

Hold that thought while we cover speeds and feeds. This 27 incher runs the same 1440p native resolution as similar OLEDs from Asus and LG. They use the same LG WOLED technology and offer similar specifications. Corsair rates the panel at 0.03ms for pixel response, with peak brightness at 1,000 nits.

Again, that's some serious punch, though it only applies to a three percent or smaller window and Corsair doesn't quote full-screen brightness, the latter arguably being what you want to know. Typically, the full-screen brightness of all OLED panels and LG panels in particular is dramatically below the peak brightness achieved in a small portion of the panel.

The refresh rate comes in at 240Hz, which is plenty, and the color coverage is rated at 98.5 percent of the DCI-P3 digital cinema gamut. Again, that's more than enough for what is predominantly a gaming display. Connectivity is likewise a strong point, with DisplayPort, HDMI, and USB-C with power delivery all provided, plus a USB hub.

It's wrapped up in a nicely put-together chassis that goes some way to justifying the $999 price, but that's the norm for OLED monitors now. They look like poor value when you can get a much larger 4K OLED TV for about the same price.

Anyway, the most important measure is image quality, and that's where we come back to the limitations of current LG OLED technology. The problem is brightness and how that translates into typical PC usage, as opposed to watching video content on an OLED TV. For the latter, the fact that the panel's peak brightness varies so much depending on how much of the screen is being lit up is tolerable. Indeed, often it's hard to notice.

On the Windows desktop, it's obvious if the panel brightness nosedives when you do something routine like opening a browser window with a predominantly white background. It's just so clunky. You can, of course, disable the ABL (automatic brightness limiter), but that just has the effect of running the display at the lowest common brightness denominator.

That's less than 200 nits, at which point you've paid $1,000 for a 27-inch 1440p panel. In games, brightness is less of an issue. In darker scenes punctuated by small, bright objects, it's easy to see what the fuss is regarding OLED technology. The per-pixel lighting, the effectively perfect contrast, the bright highlights perfectly rendered next to deep, inky black tones—it's pretty incredible.

But even in games, the full-screen limitations can be obvious. The bright desert scenes in *Cyberpunk*, for instance, can look dingy. The panel's brightness drops off when the majority of the screen is showing something bright.

That's a pity, because in many other regards, this is fabulous. It's fast, beautifully built, and nicely calibrated. But at this price, and taking into account the modest panel size and resolution, putting up with either the clunky ABL or a pretty dim display is hard to swallow. That's particularly true when you can grab one of a number of 34-inch ultrawide OLED monitors based on Samsung's QD-OLED tech that all do full-screen brightness much better and tend to have much less intrusive ABL algorithms. –**JEREMY LAIRD**

VERDICT

8

Corsair Xeneon 27QHD240

⊕ **SEE THE LIGHT** Very pacey OLED panel; Sometimes super HDR performance.

⊖ **TUNNEL VISION** Super expensive for a 1440p panel; Poor full-screen brightness.

$999, www.corsair.com

SPECIFICATIONS

Panel size	27-inch
Panel type	OLED
Resolution	2560 x 1440
Brightness	1000 nits peak
Response time	0.03ms
Refresh rate	240Hz
Contrast ratio	1M:1
Features	LG WOLED panel, 98.5% DCI-P3, adaptive sync, 1x DisplayPort 1.4, 2x HDMI 2.1, USB-C with power delivery

©UNSPLASH

Corsair's new 27-inch 1440p panel runs LG OLED tech.

Acer Predator Helios 16

A powerful RTX 4080 portable for a reasonable price

AS GAMING LAPTOPS with an Nvidia GeForce RTX 4080 stuffed inside go, the Acer Predator Helios 16 isn't the fastest. But it does have redeeming qualities, and then some.

It's a 16-inch laptop, which means it joins the likes of the Alienware X16, Asus ROG Strix Scar 16, Asus Zephyrus M16, Lenovo Legion Pro 7i, and Razer Blade 16 in a very competitive market. Like those laptops, the Helios' 16-inch frame and slim bezels make for a better compromise between screen and chassis size than most 17-inch devices.

Speaking of that screen, it's absolutely lush. It's a mini-LED panel with 1,000 dimming zones for relatively precise lighting control, plus 240Hz refresh and 2,560 by 1,600 pixels in a 16:10 aspect ratio. Admittedly, Mini LED is no microLED OLED, it's not capable of per-pixel lighting, but we'll take it over a traditional LED screen any day.

Anyway, the colours are rich, vibrant, and it doesn't struggle to deliver a punchy image like some cheaper laptops. Crank the brightness right the way up and the image is super impressive, both on the desktop and in games. Playing through *Metro Exodus Enhanced*, this display is so, so good at showing off areas with bright flames erupting out of the darkness, or rays of light breaking through windows or a hole in the roof.

But does it make up for the Helios's occasional performance deficits? The RTX 4080 and Intel Core i9-13900HX CPU are a mighty combo on paper, but game performance is a mixed bag versus other gaming laptops with similar spec sheets. Despite running its RTX 4080 at 175W—the same as pretty much every other RTX 4080 laptop we've tested—it's still often the lowest performer benchmarks, if not second-last. That said, with an RTX 4080, you're never short of frames.

As far as gaming laptops go, and especially really high performance models, the Helios 16 is as loud as you'd expect. In anything up to performance mode, it's audible, while gaming and probably a bit too loud to reasonably run full pelt out in public without some sideways glances your direction, but it's not an absolute cacophony. In turbo mode, however, this laptop produces a monstrous, borderline insufferable din.

As for the overall chassis construction, it's a little plasticky and falls short of the Razer Blade 16's slick all-alloy shell. It's also not quite as flashy as the Asus Strix Scar 16, and the power brick is pretty massive, which isn't great given this is already a heavy machine at 2.9kg, but with a fairly sleek design and plenty of ports, the initial out-of-the-box impression is still pretty good.

Finally, there's the matter of money. Every RTX 4080 gaming laptop is expensive, but at $2,300, this Acer is well priced for this sort of spec. You could pay around $2,900 for the Asus ROG Strix Scar 16 and come away with definite benefits, but still a similar laptop at its core. Alternatively, you could spend as much as $2,949 on the Alienware X16, which again has some benefits, but ends up trading blows down the bottom of the stack next to this cheaper Helios 16.

It's Lenovo's Legion Pro 7i that offers the sternest competition, going for a similar if not lower price to the Helios 16, and is probably our pick for the best gaming laptop in 2023, even if it does lack that gorgeous mini-LED panel.

For the money, then, it's easy to look past the performance dips of the Helios and focus on the broader package. The silicon is there, the chassis quality and engineering is mostly there, and the screen is absolutely there. Overall, it's a nice package for the price. **–JACOB RIDLEY**

VERDICT

8

Acer Predator Helios 16

+ PHENOMENAL COSMIC POWER Fantastic mini-LED screen; Decent price for an RTX 4080 laptop.

− ITTY BITTY LIVING SPACE Slower than most other 4080 portables; Slightly plasticky build.

$2,300, www.acer.com

BENCHMARKS

	Asus RoG Strix Scar 16	Razer Blade 16	Lenovo Legion Pro 7i	Acer Predator Helios 16
F1 22 1080p (fps)	108	106	**110**	80
F1 22 1440p (fps)	65	**82**	72	54
Cyberpunk 2077 1440p (fps)	37	**42**	39	34
Hitman 3 1080p (fps)	266	**270**	269	247
Hitman 3 1440p (fps)	171	**207**	189	189
Cinebench R23 multi-core (pts)	28,845	28,476	**29,276**	19,347
3D Mark storage (MB/s)	301	363	**522**	457

Best scores are in bold. All comparison laptops are specified with Nvidia's RTX 4080 graphics.

SPECIFICATIONS

CPU	Intel Core i9 13900HX
Boost clock	5.4GHz
GPU	Nvidia RTX 4080 (175W)
VRAM	12GB
System Memory	16GB DDR5-5600
Storage	1TB NVMe SSD
Screen	16-inch
Resolution	QHD+ 240Hz Mini LED
Weight	2.9kg

Acer's Predator Helios 16 is one of the cheaper RTX 4080 laptops currently available.

LEGION
GEFORCE RTX 4070
LEGION
Lenovo
intel
CORE

A good looking pre-built that's easy to upgrade, too.

Lenovo Legion Tower 5i

A very well thought-out pre-built gaming PC

THE LENOVO Legion Tower 5i is as much of a fully integrated gaming PC as you're going to find in the pre-built market. From top to bottom, it looks and feels like a Lenovo-built machine, yet unlike one of its biggest competitors in this space, this tower doesn't come with any non-standard parts to make upgrades a hassle. No, this is a smart-looking and convenient gaming PC.

Lenovo is taking advantage of the relatively new Nvidia GeForce RTX 4070 in this machine. It's a powerful GPU, but fits into a smaller space than the hulking behemoths that most RTX 4070 Ti, RTX 4080, and RTX 4090 cards are. The actual card that Lenovo has slotted into this machine is made to its own design. But it's compact, quiet, cool, and even has a built-in bracket to prevent stress applied to the PCIe slot in the long term.

That's been paired with an Intel Core i7 13700F. A 16-core, 24-thread processor, you're not left wanting in any way for performance with this chip, be that for gaming or editing. One of Intel's Raptor Lake chips, half of those cores are admittedly small Efficient-cores, but the bulk of gaming workloads defaults to the eight beefy Performance-cores.

This is a fiery combination for gaming and best suited to the blend of resolution and frame rate of 1440p. You could push this machine at 4K, though it's more dependent on the game at hand as to whether you'll manage over 60 fps. It's worth noting that this machine isn't equipped with the fastest RTX 4070 we've tested. It holds back more than most, which does lead to lesser performance in GPU-limited applications such as gaming.

The moderately pared-back graphics card of the Tower 5i is likely the key to its frosty operation, however. During benchmark runs, this machine is hardly audible above the background din of the office, and only in longer gaming sessions did I hear the fans really whirr to life. Even when they did wind up, it remains a relatively quiet computer compared to some. It's not a hot computer, either. The GPU hit 71°C during three runs of *Metro Exodus Enhanced Edition*, while the CPU maintained a steady 87°C under load.

FIRST IMPRESSIONS

While these sorts of PCs often use a cheaper case combined with lesser-known off-the-shelf brands, Lenovo has put together a lovely looking PC. The case is a smart gray and black mid-tower with the occasional RGB highlight, including the Legion logo down the front side, and a windowed side panel gives a glimpse into the machine's well-lit innards.

There are a host of lights you can control on the Legion, including all four of the fans included inside the case. That's two up front, one on the CPU cooler, and one on the rear exhaust. All offer user-controllable RGB lighting in the Lenovo Vantage app, which is one of the more simple manufacturer apps to navigate.

Otherwise, Lenovo's motherboard isn't much to look at, nor is the DDR5 RAM, which are two 8GB DIMMs only rated to 4200MHz (effective). This machine also has a one-year warranty that seems worth talking about, as Lenovo offers next business day on-site support and repair with this machine.

Overall, I've come away impressed by the Lenovo Legion Tower 5i. While very much still a machine from a major manufacturer, unlike Alienware, Lenovo hasn't held back this machine with non-standard parts, yet it's a smart-looking and operating machine.

It's rare that I'm impressed by the finish of a pre-built machine, and even rarer that it doesn't just look the part, it performs great too. Ultimately, I'd be pretty happy with this machine beside my desk each day. The Lenovo Legion Tower 5i is a thoroughly thought-out prebuilt gaming PC, from its choice of components to overall finish. While the motherboard and RAM are a bit basic, its overall polish makes it one to consider. **–JACOB RIDLEY**

BENCHMARKS

	Lenovo Legion Tower 5i	**VRLA Tech Titan**	**Skytech Chronos 2**
3DMark Time Spy Extreme (Index)	8,144	**8,379**	8,331
Far Cry 6 1080p (fps)	**144**	135	99
Metro Exodus Enhanced 1440p (fps)	68	**75**	56
F1 22 4K (fps)	31	**32**	**32**
Total War: Warhammer III 1080p (fps)	132	**138**	133
PCMark 10 (index)	6,571	**6,824**	5,573

Best scores are in bold. All gaming tests were done at highest or ultra settings. VRLA Tech Titan featured an AMD Ryzen 5 7600, MSI GeForce RTX 4070, and 16GB DDR5 RAM. Skytech Chronos 2 (see page 50) featured an AMD Ryzen 5 5600X, Zotac Twin Edge GeForce RTX 4070, and 16GB DDR4 RAM.

VERDICT

8

Lenovo Legion Tower 5i

+ **TOWERING ACHIEVEMENT** Polished; Quiet even while gaming; Standard parts; Decent-sounding warranty.

− **TUMBLE TOWER** Slower RTX 4070 than some; Basic motherboard.

$1,700, www.lenovo.com

SPECIFICATIONS

CPU	Intel Core i7 13700F
GPU	Xx Nvidia GeForce RTX 4070
Cooling	4x Skytech RGB 120mm Fans, single-tower air cooler
Memory	16GB (2x8GB) DDR5-4400
Storage	Samsung MZVL21T0HCLR 1TB
PSU	500W
Volume	26L
Ports	Top: 2 x USB-A 3.2 Gen 1, Headphone / mic combo, Rear: 1 x USB-C 3.2 Gen 2, 2 x USB-A 3.2 Gen 1, 4 x USB-A 2.0, HDMI 2.1, 3 x DisplayPort 1.4a, Ethernet (RJ45), LED switch for ARGB lighting, 3 x audio ports
Wireless Connectivity	WiFi 6E, Bluetooth 5.2
Dimensions	425.9 x 205 x 396.9mm
Weight	16kg
Warranty	One-year on-site support

Alienware M16

A mostly desk-bound beast, but with plenty of power

THE ALIENWARE M16 is a new 16-inch beast designed to take over from its 15.6-inch predecessor. With Nvidia's RTX 40-Series graphics and the choice between Intel and AMD's latest processors, there's plenty to dig into here.

Engineering-wise, we're seeing more machines moving away from the slimline build of late to accommodate new-generation components and deliver better thermals as opposed to slick style. So while this remains a chunkier laptop by historical standards, in this new landscape the M16 feels almost thin. Almost. When the Asus ROG Strix Scar 16 weighs in at 2.5kg, the Alienware's 3.25kg heft is certainly something to consider if you're after true portability.

The rest of the design is firmly within the established Alienware M-Series' wheelhouse. The centered keyboard, embossed '16' on the back, and additional space towards the rear, have been seen time and again. If it wasn't for that 16-inch display and physical marker on the lid, this could be any Alienware M laptop from the last four years.

Likewise, it's as solid and durable as ever, with a matte coating that promises to keep things soft to the touch, but equally resistant to fingerprints. You're still not getting the luxurious aluminum and magnesium alloy of the X-Series, but this is still an aluminum build. Yet, it would be interesting to see Alienware playing with its look in future iterations.

Unlike last year's M15, which framed its keyboard deck with raised edges, everything is flat here. That gives the illusion of far more space. When combined with the excellent spacing on this deck, this makes for comfortable typing. The keyboard itself is nice and responsive, with a tactile response despite the rubber dome construction.

The M16 does also ship with a Cherry MX mechanical keyboard in more expensive configurations if you're looking to boost the feel. While the keyboard gives you plenty of space, the trackpad is remarkably small. It's placed so close to the edge of the main body that it's almost impossible to use with precision or comfort when placed on a lap. Pity.

PORT PERFORMANCE

As for ports, you get two speedy USB-C Gen 2 ports, as well as plenty of USB-As, ethernet, and a full SD card reader here. Under the hood, you'll find four fans and a vapor chamber setup all working to keep those temperatures down. While the Alienware M15 R7 was among the loudest machines, the M16 is much improved. You can still toggle everything up that max RPM din, but everyday play works well at standard fan settings.

The display on our test unit is a QHD+ 16-inch IPS panel running at 165Hz, the cheapest panel available in the current lineup. No, it's not following the mini-LED trend du jour, but it still offers plenty of color, contrast, and viewing angles.

And then there's the main attraction, the CPU-GPU combo. We took the RTX 4060 and Intel i7-13700HX option for a spin in order to get a feel for a lower-end M16. Happily, it comes surprisingly close to the performance of the higher-specced RTX 3070 Ti under the hood of the old M15 R7. A Time Spy score of 10,139 just grazes the M15's 10,722 and in-game benchmarks exceed those of the previous generation. Even with an RTX 4060 at the helm, the M16 was hitting over 100fps in the vast majority of my 1080p and 1440p tests across both High and Ultra settings.

The Alienware M-Series has always been a solid go-to for performance that won't break the bank, and that's as true as ever. If you're after a more portable device, the Asus ROG Zephyrus G14 is the obvious pick, while the Asus ROG Strix 16 gives you the same 16-inch form factor minus three quarters of a kilo. But if you're looking for a desktop-first device with a little portability in a pinch, this is an excellent alternative to the Razer Blade 18 and Alienware M18 at the top of the price spectrum. **–TABITHA BAKER**

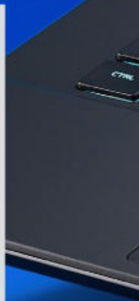
VERDICT
7

Alienware M16

+ HIGHLY RATED Solid build; Strong performance for the specification.

− OVER WEIGHTED Too big to be truly portable; Style is a little dated

$1,899, www.alienware.com



SPECIFICATIONS

Display	16-inch QHD+ (2560 x 1600) @ 165Hz
Processor	Intel i7-13700HX
GPU	RTX 4060
RAM	16GB DDR5 4800MHz
Storage	512GB PCIe NVMe M.2 SSD
Connectivity	Killer Wi-Fi 6E, Bluetooth
Ports	1x HDMI 2.1, 1x USB 3.2 Gen 1 with powershare, 1x USB 3.2 Gen 1, 2x USB-C Gen 2 with DisplayPort, 1x RJ45 Ethernet, 1x 3.5mm audio, 1x mini-Display port, 1x SD card
Dimensions	36.8 x 2.5 x 28.9cm
Weight	3.25kgw

BENCHMARKS

	1080p high	1080p ultra	1440p high	1440p ultra
Shadow of the Tomb Raider (fps)	159	150	120	111
Total War: Three Kingdoms (fps)	132	102	105	74
Rainbow Six Extraction (fps)	190	149	122	97
Returnal (fps)	124	98	103	87
Hitman 3 (fps)	92	86	83	79

The M16 moves Alienware's familiar aesthetic into a new 16-inch form factor.

Elgato Wave DX

XLR audio-quality XLR in a cool-looking set of boxes

IF YOU WANT PROPER pro-level audio recording, you'll need what's known as an XLR mic, a device that's becoming increasingly popular on PC thanks to the boom in streaming and podcasting. Enter an increasing number of brands jumping on the XLR bandwagon, the latest of which is Elgato Wave DX.

As an XLR mic, the Wave DX was a little fiddly to set up. It's not a case of plugging in one cable and the mic works. Instead, it's a multi-stage procedure that relies on you having a few things to hand.

To get the Wave DX working, you'll need the mic itself, as well as an XLR cable (sold separately, but any XLR cable should do) and an interface of some form for the mic, which in turn plugs into your PC. In theory, this mic should work with any XLR interface, but for the sake of unity and convenience, we used Elgato's own Wave XLR, which gives you access to onboard gain control so as not to clutter the sleek design of the Wave DX itself.

Once you've jumped through a couple of hoops and set the Wave DX up on a mic arm (there isn't a tripod stand in the box), you're ready to go. The setup isn't as bad as all the above sounds; it's really just plugging in a handful of cables. It also helps that every part of this kit is well built and simple to operate.

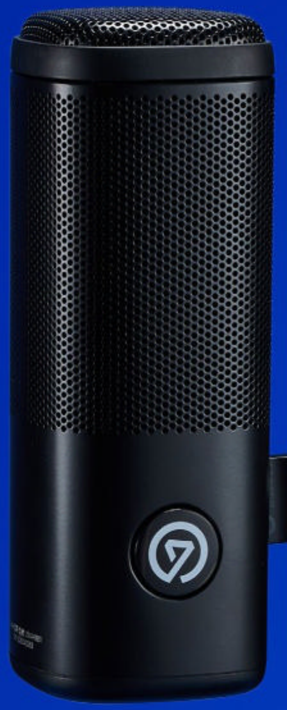
Moreover, the Wave DX is minimalist and elegant in all the right ways, and has a sturdy, mostly metal construction. Yet, there's no unnecessary bulkiness due to a shock mount or external pop filter like you get with other mics thanks to the Wave DX's internal pop filter. The same goes for the boom arm and Wave XLR interface too, which although is made of plastic, doesn't feel cheap.

Of course, the most important thing with a mic is how it sounds, and here the news is very good. The Wave DX offers a cardioid polar pattern, which is ideal for voices, although it isn't a condenser mic like a lot of more affordable options. Instead, the Wave DX is actually a dynamic microphone, which means it's better suited to capturing louder noises—ideal if you bellow into a mic. As a dynamic microphone, it also doesn't require any external power, unlike condensers, whose XLR based versions will need to draw power from somewhere.

Anyway, this captures marvelous audio quality. Vocals have plenty of body, along with excellent clarity. Elgato's XLR mic also does a brilliant job of cancelling out most background noise. In addition, you can get a plug-in that can cancel noise even further. The only real flaw involves plosives that come through with a slightly annoying hissing noise, proving that while the internal pop filter offers more of a design minded way of removing harsh sounds, an external physical barrier may offer a more surefire way.

The mic itself is $99, which puts it in the more affordable category for XLR mics, and makes it brilliant value. The value proposition is obviously more complicated when you add all the other bits needed to get it working, which actually come to more than the mic itself. The Wave XLR interface is $160, while the boom arm clocks in at $90, and the separate XLR cable sits at $20. In essence, you'll be paying close to $400 to get all this up and running.

Still, overall the Wave DX is a great microphone with some excellent clarity and full-bodied audio that should really take your streaming and content creation game to the next level. With all the kit bundled in, it is quite expensive, but if you want a sleek and minimalistic-looking setup to stream with, this is undoubtedly a fine choice. **–REECE BITHREY**



VERDICT

8

Elgato Wave DX

+ LISTEN UP Brilliant audio quality; Doesn't pick up too much background noise.

– WHAT WAS THAT? Requires a lot of extra kit, which costs quite a bit more money.

$99, www.elgato.com

SPECIFICATIONS

Frequency	50–15,000Hz
Directional patterns	Unidirectional Cardioid Polar Pattern
Controls	Volume dial, mute button (on Wave XLR)
Recording sample rate	96kHz
Bit depth	24-bit
Weight	440g

WAVE XLR
48V

The Wave DX is actually a dynamic microphone, which means it's better suited to capturing louder noises.

SUBSCRIBE TODAY

Find your next great read

On iOS & Android!

Subscribe today and get instant access on your iPad, iPhone or Android device.

www.magazinesdirect.com/B3XMPC

Logitech Pro X 2 Lightspeed

This graphene drivers-equipped headset is another win for Logitech

THE LOGITECH Pro X 2 Lightspeed has some massive shoes to fill. Its predecessor, the Logitech Pro X Lightspeed, may be almost three years old, but Logitech did such a fantastic job with it, it's become iconic with its gorgeous luxe gaming aesthetic and impressive sound.

But Logitech has rolled up its sleeves not just to refine that already stunning design on the Logitech Pro X Lightspeed, but also to improve the innards—or more specifically, the diaphragm inside. To usurp one of the best gaming headsets of the last 10 years, Logitech created its 90 percent graphene diaphragm-fitted drivers, all for the sake of giving you an even better gaming experience. Its efforts were not in vain.

The Logitech Pro X 2 Lightspeed boasts some external improvements over its predecessor. First, it's noticeably lighter—40g less, to be specific—and more compact, which makes it more travel-friendly. It's a nice perk, as I adore its overall look, which blends elegance with that pro-gamer style, and I want to take it on my travels.

To this end, there's also a rotating hinge on each yoke, which lets you rotate the ear cups to flatten the headset for stowing in the travel pouch. That's not to mention it allows the headset to conform to different head shapes and improve its comfort. Adding to its versatility and travel-friendliness are the detachable 6mm cardioid mic and three different connectivity options. There's also Logitech's LIGHTSPEED wireless that has a maximum range of 30m, as well as Bluetooth and 3.5mm wired connectivity.

Both the earcups and headband are still swathed in soft-to-touch leatherette, but Logitech throws in a pair of velour earpads that you can switch for the leatherettes. Because it's lighter, it feels better than my Pro X Lightspeed. With Logitech touting how light its graphene drivers are, I'm surprised it couldn't design the headset to be a lot lighter.

Now, let's talk about those graphene audio drivers. They succeed in delivering a more accurate and detailed audio, as well as a more immersive experience. While on the warmer side, the highs are detailed, the mids are full without getting muddy, and there's a low end that is present but well controlled, and never overpowers the rest of the sound frequencies. In stereo mode, everything sounds great.

I do have mixed feelings about the DTS X Spatial Sound. Although that virtual surround sound makes everything more immersive, especially compared to its predecessor, it doesn't make the soundstage wider, just more three-dimensional. It also affects the frequency range—the mids tend to be even more pronounced, so you hear a lot more of the environmental sounds and score.

The mic has plenty of volume as well. It's not the crispest, but does a good job of minimizing background noise and handling sibilance. The G Hub app offers a lot of customizations, as well as game-specific presets, which I liked using. Then there's the decent battery life of up to 50 hours on a single charge. That's not too bad, but there are certainly longer-lasting headsets out there. If you play for eight hours a day, just make a habit of charging at the end of every week.

Compared to the best wireless gaming headsets, this sits comfortably in the mid range. There are pricier options, like the Audeze Maxwell, the SteelSeries Arctis Nova Pro Wireless, and Turtle Beach Stealth Pro. There are also cheaper alternatives, like the Corsair HS55 Wireless and Corsair HS80 RGB USB. However, with its new drivers, fantastic sound stage and imaging, and comfortable fit, not to mention its features, it deserves to be in the conversation with the more premium headsets on that list, so you're really getting great value. **–MICHELLE RAE UY**

VERDICT **9**

Logitech Pro X 2 Lightspeed

+ **LIGHTSPEED:** Detailed audio; Immersive soundstage; DTS Super Stereo for music; Decently lightweight and comfortable; Feature-rich. app. − **LIGHTWEIGHT** Loses some headroom in games with surround sound; Not cheap; Only five band EQ.

$249, www.logitechg.com

SPECIFICATIONS

Dimensions	176 x 95 x 189mm
Driver	Graphene 50 mm
Magnet	Neodymium
Frequency Response	20 Hz-20 KHz
Impedance	38 Ohms
Sensitivity	87.8 dB SPL @ 1 mW & 1 cm
Battery Life	up to 50h
Wireless range	up to 30m
Connection Type	2.4 GHz LIGHTSPEED, Bluetooth, 3.5mm wired
Platforms	PC, Mac, Playstation, Xbox, Switch, Mobile
Mic	Detachable 6mm cardioid mic
DTS Headphone	X 2.0
Weight	12.16oz (345g)

Corsair TC100 Relaxed

A relaxed gaming chair at a very relaxed price

CORSAIR'S REFINED racer-style chair is not going to have you remortgaging for the privilege of sitting in it. If you're happy to make a couple of sacrifices, this is a good contender for the best cheap gaming chair. The Corsair T3 Rush had been keeping us going on the side of affordable gaming chairs, so I was expecting great things from this new addition to the ecosystem. I've not been disappointed.

In a lot of ways, the TC100 and T3 chairs are highly comparable, not least in their simple colourway and 160 degree recline. But the main thing to point out is the price difference. At $70 less than the T3, you expect some compromise from the TC100, but I have yet to discern how Corsair has managed to drop the price so much and for essentially more chair.

It's a little shorter, with an 81cm backrest, but instead of tall, the TC100 Relaxed goes broad. It has got a wider backrest, more cushion in the seat, and gentler side cushion angles for those thick thighs, hence the "relaxed" nomenclature.

Those of us on the stockier side had no trouble sitting in it at the office, and I'm not constantly fighting to reach the headrest, since I'm not the tallest out there. I've never been a huge fan of Corsair headrest attachments, though. The straps are very short, and while slotting them through the two backrest holes might sound practical, it means you're limited when it comes to adjustability. Those pushing 6'2" will need to reconsider their options, but the headrest and accompanying cushions are comfy enough, and are included with the chair.

NO ARM DONE

The major drawback with the TC100 Relaxed is the 2D armrests. It means you only benefit from up, down, in, and out adjustability, and compared to the T3 Rush and other chairs with 4D armrests, it's a little disappointing, but I suppose the company had to save money somewhere. The short distance between the armrests means I can rest my elbows without any rotational help, though, and the lack of forward and back movement isn't too much of a problem for me. They're just a tiny bit rattly—something I've come to expect from a $250 gaming chair.

Putting it together, you'll be reminded of the low cost, too. While everything did align well, and the materials are more than fit for purpose, I did have a little trouble getting some of the bolts in place. That was due to the marbles of balled-up synthetic material around the holes, which had evidently been burned through. Aside from that, it took me 40 minutes to put together—even without instructions in the box, it was relatively straightforward.

Manufacturing aside, I've been thoroughly impressed with the aesthetic. This fabric model doesn't feel too flashy, and while the backrest has slightly wider wings than its sister, the T3 Rush, the angles are much less sharp. There's an intricate, almost honeycomb patterning on the backrest, which is nowhere near as in-your-face as the majority of gaming chairs I've tested.

I appreciate that both the leatherette and fabric versions of the TC100 Relaxed come in at the same price, too, as often you see fabric gaming chairs models going for a little more. I can confirm that not only is the fabric soft as anything; it's also breathable, and stops you from sticking to the surface when wearing shorts in the height of summer.

At the end of the day, it all comes down to price. At $320, we were smitten with the T3 Rush, so the fact that the TC100 Relaxed comes in at the distinctly more affordable price of $250, with only a few small compromises, gives me a lot of hope for the future of cheap gaming chairs. The thick cushion, broad design, and refined styling make this a good gaming chair, but the fact that Corsair has managed to get the price down without compromising on comfort is what makes the TC100 Relaxed a great gaming chair. **–KATIE WICKENS**

VERDICT
9

Corsair TC100 Relaxed

+ RELAXING Subtle aesthetic; Space to sit cross legged; Good price for both fabric and leatherette; Great recline; Genuinely comfy.

− BORING: Rickety 2D armrests; Limited headrest adjustability; Minor assembly issues.

$250, www.corsair.com

SPECIFICATIONS

Seat type	Soft bucket
Recline	90–160 degrees
Weight capacity	120kg/264lbs
Max height	188cm/6ft 2in
Warranty	Two years
Available colours	Black and gray / black and black

Lexar NM790

A cost-effective and snappy storage solution

GEN 5.0 PCIE SSD technology is here and among us. It's lightning fast, there's no denying that, but with any new technology, it comes at a premium. It will be a while until it's available at more of a budget price point. What this means for our humble industry-standard PCIe 4.0 SSDs is that prices are more affordable than ever. A top-end PCIe 4.0 SSD is still no slouch by any means, and is plenty fast enough for most computing tasks. Lexar's latest NM790 drive claims to provide a speedy performance while consuming 40 percent less power than DRAM cache-enabled PCIe Gen 4 SSDs. Should you hold off from PCIe 5.0 and add this PCIe 4.0 drive to your setup?

Visually speaking, there's nothing too groundbreaking on this drive. It doesn't come with a heatsink variant, and is relatively simple in design, yet that's not a major issue here. Its NAND modules on the top of the driver are covered by a thin sticker featuring the Lexar branding. Its black and silver design suggests a tilt towards the premium market, and is suitable for most builds, adding a little bit of character compared to an all-black SSD. Included in the box is an M.2 screw, too—not every SSD comes included with one of these, so it's nice to find one bundled in here. We'd be lying if we said we hadn't spent a large chunk of time scrambling around on the floor trying to find these after misplacing them, so it's good to have a backup.

Lexar's drive comes with four capacity options: 500GB, 1TB, 2TB, and even a 4TB variant. Now, *that's* a healthy line-up to pick from. Our review sample is the 1TB model, and this comes in at under $100. The choice of capacity is subjective and dependent on your needs for the drive. It can come down to whether this will be used as a primary drive, a back-up storage solution, or to hold large files such as games or photos/videos, for example.

However, there is a difference in performance between the different models. The 500GB version is slower than the 1TB, 2TB, and 4TB offerings. The larger-capacity SSDs have read speeds of up to 7,200MB/s and write speeds of up to 6,500MB/s. However, the 500GB is slightly lagging behind with read speeds of up to 7,400MB/s and write speeds of up to 4,400MB/s, so bear that in mind. We would recommend saving that little bit extra and going for the 1TB model that we are testing here over the 500GB one.

POWER PERFORMANCE

Speaking of performance, we benched this using Crystal Disk Mark 5.50—the same benchmark we do for our SSDs in our main feature builds each issue. On the QD32 Sequential Read tests, we were seeing results that were only very slightly below the quoted 7,200MB/s. This goes for the QD32 Sequential Write tests too—these were around 6,400MB/s, which is very strong for a sub-$100 SSD. Other features that impressed us were the power efficiency and support for HMB 3.0 and Dynamic SLC Caching. What this means is that it can work in tandem with your RAM to push its performance to the top level, and also dynamically convert NAND to cache memory. This means the Lexar can avoid using a more expensive DRAM for the cache, which would consume more power, therefore helping with the efficiency. It's a clever way of keeping the price down.

The NM790 also has a 3.5W power draw, which is up to half the draw of previous Lexar PCIe 4.0 SSDs. It's also a lot less than other competitor drives at around the same price bracket.

What the Lexar NM790 shows is that you can get excellent PCIe 4.0 speeds at a much lower price than previously. It offers dependable performance while running efficiently at 3.5W. Sure, the lower costs do come down to the lack of a heatsink, which would also improve performance further, but if your motherboard has a pre-installed heatsink for the uppermost M.2 slot, this shouldn't be an issue. The design is clean, meaning that even if you don't have a heatsink cover, it should fit right in with your PC's theming. At $70 for this 1TB model, we really can't complain, especially as the read and write speeds are lightning fast, too. **–SAM LEWIS**

VERDICT
9

Lexar NM790

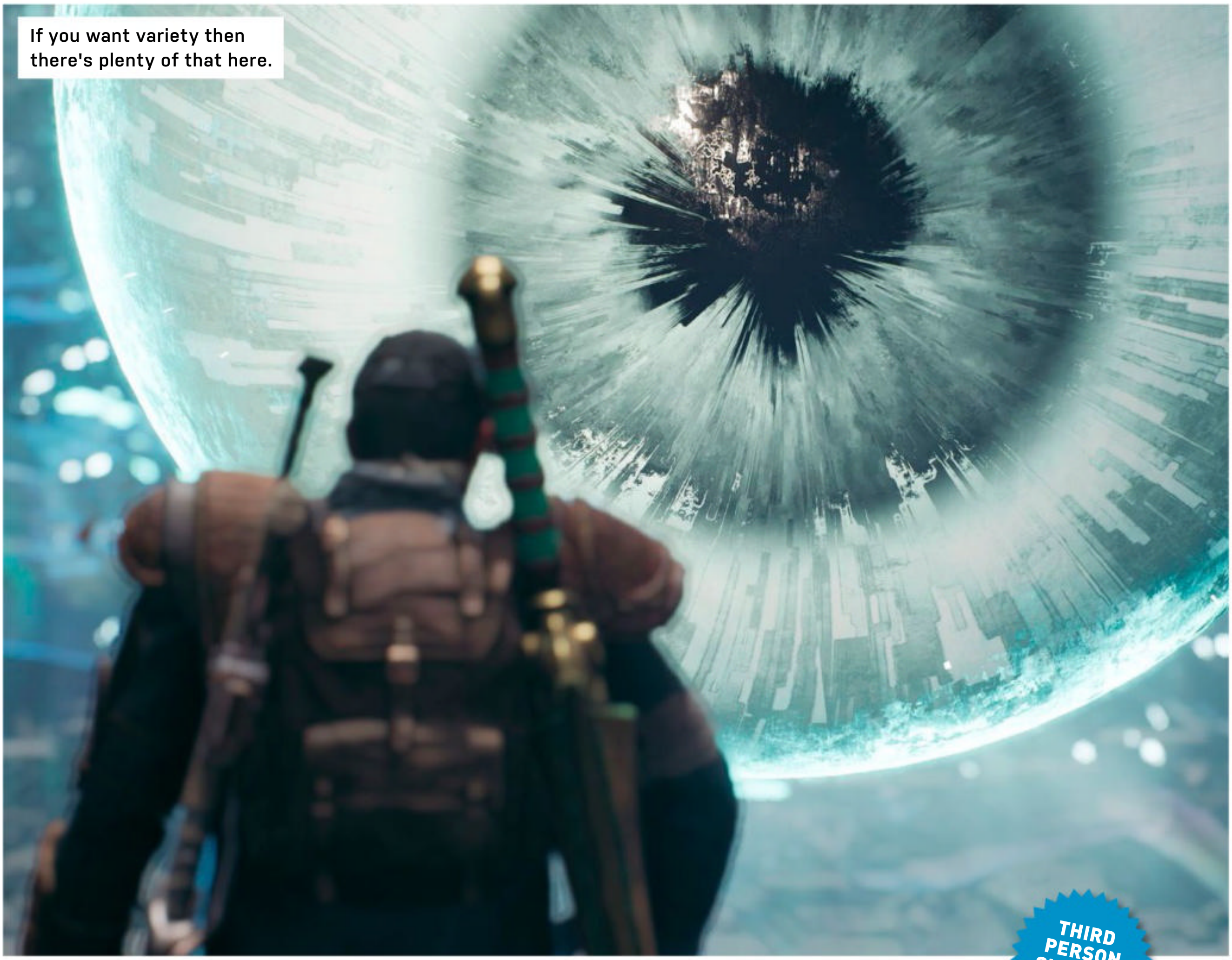
➕ **SOLID STATE DRIVE** Snappy performance; Clean design; Good power efficiency; Strong TBW.

➖ **SORRY STATE DRIVE** No heatsink option.

$70, www.lexar.com

SPECIFICATIONS

Format	M.2
Capacity	1TB (version tested)
Interface	PCIe 4.0
Sequential Read	Up to 7,400MB/s
Sequential Write	Up to 6,500MB/s
TBW	1000TBW (1TB version tested)
MTBF	1,500,000 hours
Warranty	5 years



If you want variety then there's plenty of that here.

THIRD PERSON SHOOTER

Remnant 2

Makes subverting expectations a habit

I AM A SPACE NINJA, carving up robot sentinels on an artificial planet stranded in time. A few hours ago, I was blasting British-accented elves off a dilapidated clocktower with a gun that fires cubes. Before that, I was having my life drained by a cursed board game in an antechamber of a vast golden palace.

If variety is the spice of life, then *Remnant 2* is a blazing hot videogame chilli and a deceptively complex bit of game design. It takes the over-the-shoulder shooting of *Gears of War*, welds it to *Dark Souls*' twitchy dodge-rolling and checkpointed level progression, then feeds it through a procedural generation algorithm that randomizes not just level layouts, but the entire structure of the campaign.

All this was true with 2019's *Remnant: From the Ashes*, and the sequel paints on a bigger canvas with finer brushes. You'll see that lessons have been learned straight away in how much quicker *Remnant 2* gets to the fun stuff. Like the first game, *Remnant 2* starts out with your custom-made character journeying through a post-apocalyptic Earth that, until recently, had been ravaged by a hostile tree-like race of creatures known as the Root.

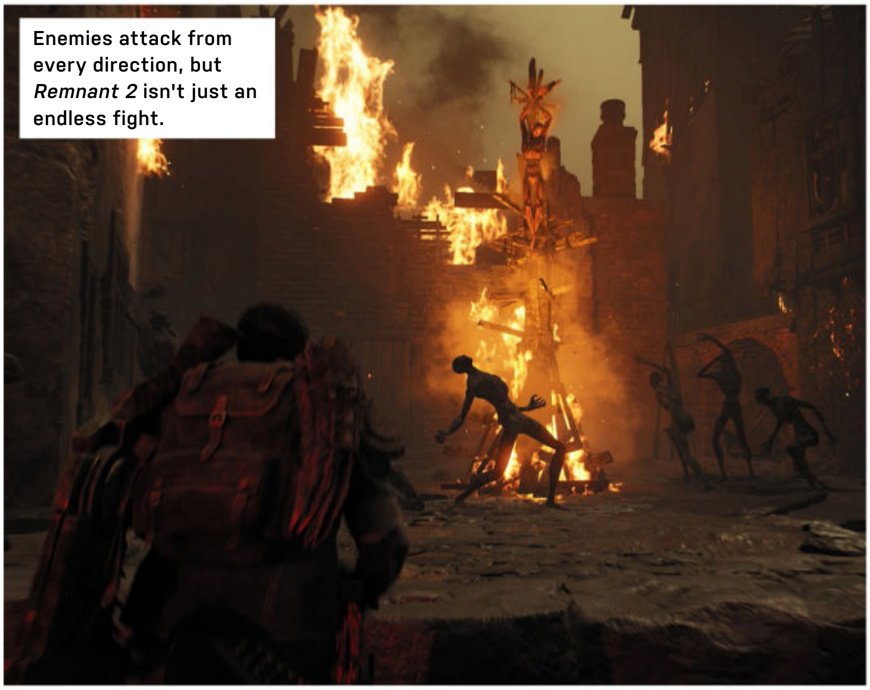
In the first game, it was a dirge of an opening that lasted several tedious hours. In the sequel, you're on Earth long enough to complete the tutorial, and that's it. Within 40 minutes, you've discovered the conclave of survivors that is Ward 13, and traveled through a glowing red crystal to an entirely new realm.

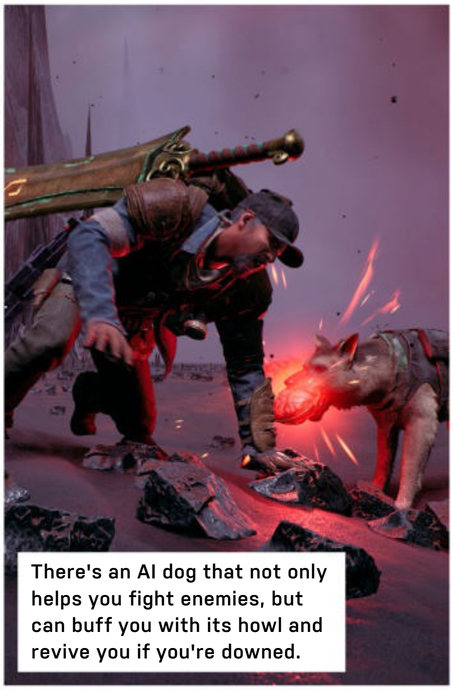
All these environments are procedurally generated, and while I spotted a few recurring level tiles on my adventure, *Remnant 2*'s maps felt unique and hand-crafted most of the time. Yet, what impresses most is not how these spaces look, but how rewarding they are to explore.

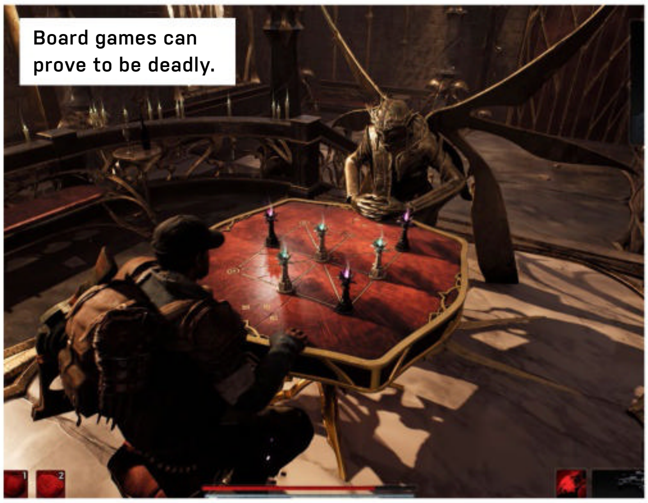
Some quests have multiple potential resolutions, while others actively seek you out, literally yanking you into a new area like *Arkham Knight*'s "Man-Bat" side-quest. All, some, or none of this could happen to you on your adventure. The giant blue elf lady who's been front and centre in all the marketing for *Remnant 2*? Never saw her. Not once.

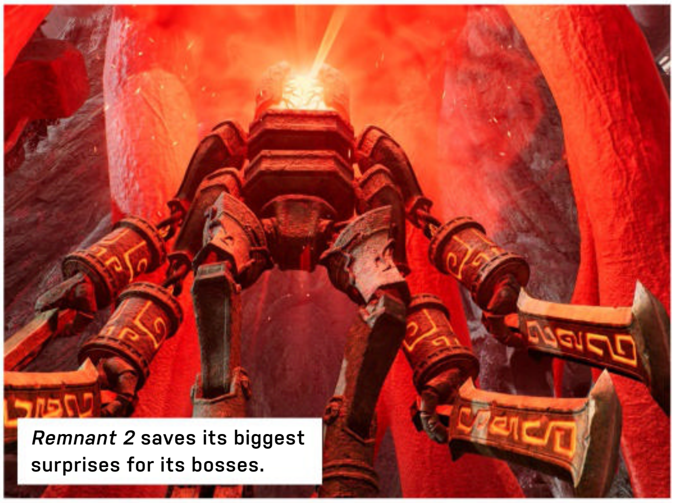
There's a potential counter-argument here, which is why not let people experience everything in one go? Well,

© GEARBOX PUBLISHING


Enemies attack from every direction, but *Remnant 2* isn't just an endless fight.


There's an AI dog that not only helps you fight enemies, but can buff you with its howl and revive you if you're downed.


Board games can prove to be deadly.


Remnant 2 saves its biggest surprises for its bosses.

I prefer a game that takes 20 hours to complete, and has me wanting more one that eats up 100 hours and leaves me wondering how the heck I'll find the time to play it again.

BOSS BATTLES

Naturally, *Remnant 2* saves its biggest surprises for its bosses, although not every boss is brilliant. A few dungeons I explored ended with me fighting a souped-up version of a regular enemy. On the other side of that coin, however, is a giant alien god that can punch through reality, and a living Root hive that crushes the platforms you fight it from, sending you tumbling into the void unless you leap out of the way in time.

More broadly, the way *Remnant 2* filters combat encounters into its procedurally generated levels impresses. Enemies attack from all angles, requiring you to be constantly vigilant about your surroundings. But it isn't an endless, shapeless onslaught either; it ebbs and flows between tense and intense. Overall, combat is both entertaining and rewarding.

The same can't be said for *Remnant*'s overarching narrative, however. There are tons of interesting stories hidden within *Remnant 2*'s worlds. The main plot, however, is even more incidental than last time, a "find three things to save the universe" affair that is very basic and lacks any interesting twists or characters.

Still, perhaps that's the price for a game that refreshes itself with every other step you take. I might not take any unifying life lesson from *Remnant 2*, but there are a dozen smaller moments that'll be bouncing around my head for a good while. It's a self-assembling experiential blind bag, with layers upon layers of colourful, plasticky fun. **–RICK LANE**

VERDICT
8

Remnant 2

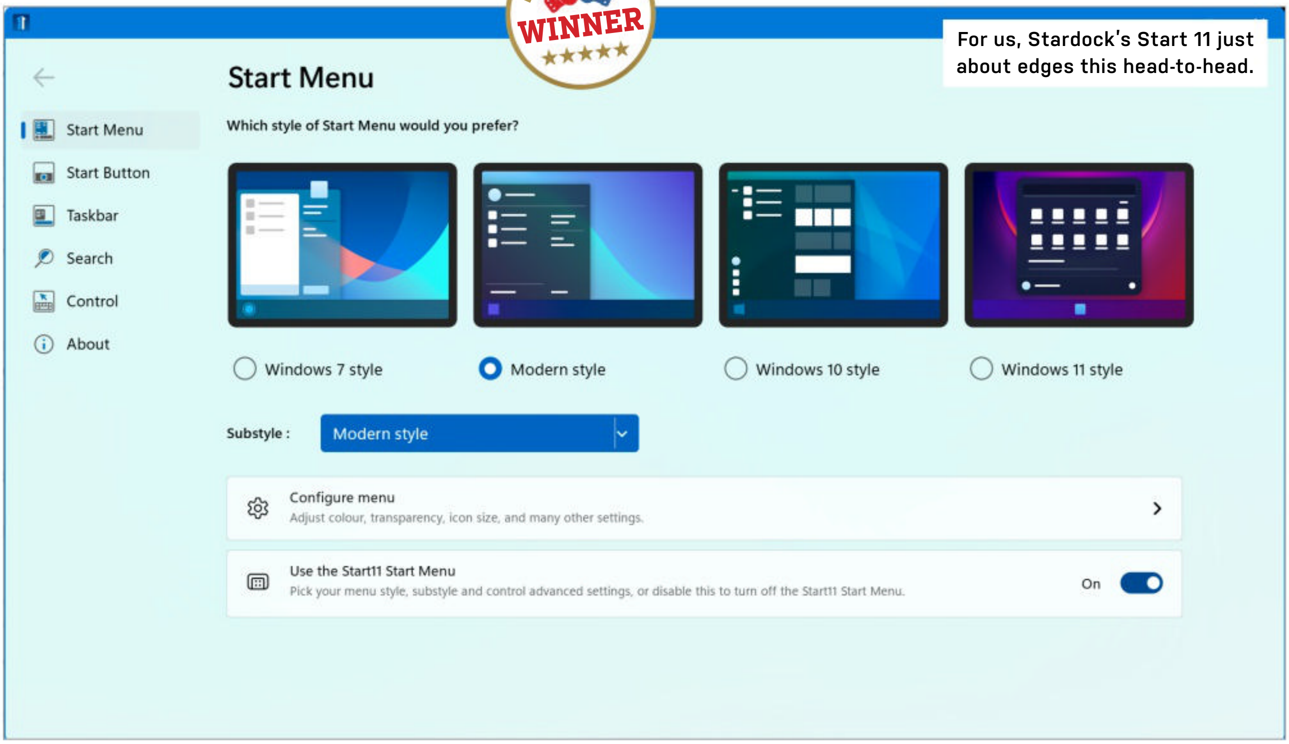
+ GREAT EXPECTATIONS Procedurally generated uniqueness; Brilliant bosses; Entertaining combat.

– WHAT THE DICKENS? Basic core narrative; Where's the giant blue elf lady?

RECOMMENDED SPECS CPU, Intel i5-10600k / AMD R5 3600. GPU, GeForce RTX 2060 / AMD Radeon RX 5700. RAM, 16GB.

$49.99, www.remnantgame.com, M-rated

HEAD TO HEAD WINNER ★★★★★



Start Menu

Which style of Start Menu would you prefer?

○ Windows 7 style ● Modern style ○ Windows 10 style ○ Windows 11 style

Substyle : Modern style

Configure menu
Adjust colour, transparency, icon size, and many other settings.

Use the Start11 Start Menu
Pick your menu style, substyle and control advanced settings, or disable this to turn off the Start11 Start Menu. On

For us, Stardock's Start 11 just about edges this head-to-head.

Start 11 vs StartAllBack

Change how the Start menu looks with these apps

THE WINDOWS 11 TASKBAR and Start menu have been, shall we say, a little divisive. There hasn't been a storm of complaint like this since the last time Microsoft tried to shake up the way we interact with our computer's operating system, and while Windows 11 doesn't make changes to the extent Windows 8 did, its pared-back menu has led those more used to the way Windows 7 and 10 worked to feel that something is missing.

Enter the third-party software. Stardock had a popular app that 'fixed' Windows 8's Start menu, called Start8, and it lives on today in the form of Start11. StartAllBack does a similar thing, but rather than confining itself to the Start menu, it also makes changes to the Taskbar, Explorer, Control Panel, contextual menus, and UI color.

Both apps can be tried for free, so you can test them out and decide which approach to customizing the Windows 11 Start menu you prefer before making a financial commitment.

There are actually a few things you can do in Windows to undo some of the most egregious interface changes, the easiest of which is to move the Start button back to the left-hand corner. To do this, right-click the Windows 11 Taskbar and choose Taskbar Settings, then drop down the Taskbar Behaviors section of the settings pane that appears. From here, choose Left instead of Center as your Taskbar Alignment. From the Personalization > Taskbar pane, you can also remove chat and the search box from the Taskbar if you want to, as well as control how apps get your attention with badges or by flashing.

Alternatively, you could use it the way Microsoft intended, taking the time to get used to the new way of doing things and accept that the good people from Redmond, Washington know how to design a PC UI. We thought not! Let's get customizing!

START11

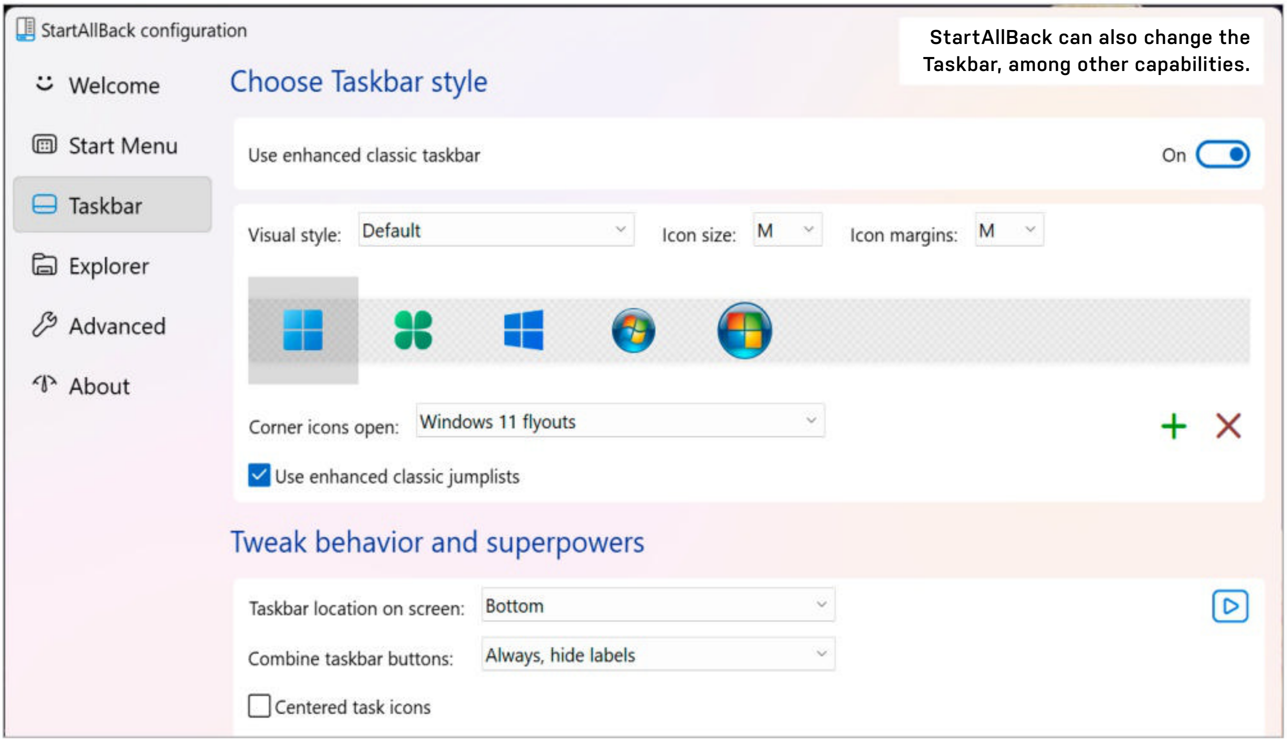
Stardock's app has a couple options for customizing your Start menu. There's a menu that looks a lot like that from Windows 7, one that looks like Windows 10's, and a 'Modern' menu of Stardock's own devising. It's this Modern menu that has become our favorite in testing, as while aping Microsoft's past glories is nice, it's good to see a bit of thought put into taking the Start menu forward in a different direction.

Start11 can be purchased for a single PC as a license that covers five devices, or as part of Stardock's Object Desktop subscription, which nets you a whole customization package of apps for an annual fee. You can also get it on Steam. It receives frequent updates, with recent patches adding improved support for multiple monitors, touch devices, and being able to close an individual window from the Taskbar instead of having to close every window an app has open.

Alongside the replacement Start menus, there's custom Start button support, Taskbar options that affect how apps are grouped and how big they are while minimized, colors and textures, and how it behaves across multiple screens.

There's also an option to use Start 11's search functionality instead of Windows', which ties in with Stardock's Fences organization app from Object Desktop. It adds filters to your search results, allows you to search in open Edge tabs, and can search file contents, too. You can even add Start menu shortcuts to your network drives if you want to.

© START 11



Choose Taskbar style

Use enhanced classic taskbar: On

Visual style: Default | Icon size: M | Icon margins: M

Corner icons open: Windows 11 flyouts

☑ Use enhanced classic jumplists

Tweak behavior and superpowers

Taskbar location on screen: Bottom

Combine taskbar buttons: Always, hide labels

☐ Centered task icons

StartAllBack can also change the Taskbar, among other capabilities.

Once you've installed and configured the software, you can run the app again to change your options, or right-click on the Taskbar to make alterations.

STARTALLBACK

This app, which is slightly mysterious about its origins (a link on the license key page goes to a Russian-language site), offers more options and granular control than Start11, but achieves broadly the same aims. It's available as a single, double, or triple license, depending on how many PCs you want to install it on. There's no subscription option, so you only pay once.

There are three main 'themes' available, called Proper 11, Kinda 10, and Remastered 7, all of which overhaul the appearance of your Windows 11 desktop in various ways, including the Start button, its menu, and the color of the Taskbar. If you're not satisfied with these, you can delve into their settings.

The Start menus are all of the two-column variety, straight out of Windows 7, with applications on the left and documents on the right. Changes you make in the app are reflected immediately in the Windows UI, with no clicking of OK or Apply needed. You can delve into some serious detail with the items on the menu and their behavior, too, choosing which folders to display on the right-hand side.

From StartAllBack, it's also possible to change the Windows logo on the Start button, with an angled Windows 10-alike, plus some 7 or Vista-style 3D rounded effects, available alongside the flat-on Windows 11 logo and even a green, shamrock-like symbol.

There's more to StartAllBack than just Start menus, however. It's also capable of changing the Taskbar, and the interface of Explorer windows. Windows 11's ribbon interface can be as annoying as its Start menu changes, hiding the option you want out of sight behind a drop-down, so the ability to have a Windows 10-like cacophony of places to click, as well as Windows 11 or 7-inspired views, is nice to have.

Moving onto the rest of the Taskbar, StartAllBack allows you to split it into sections. Want your Start menu, search box, and widgets in the corner, but application icons in the middle? It's got your back. You can also make the Taskbar transparent—either completely, or just the unpopulated sections.

Unfortunately, in our testing we found that StartAllBack exhibited some unusual behavior. Once we'd installed it, configured it, used it for a bit, then restarted our test PC, it seemed to disappear, the app no longer visible in search. The only way we could get back to the settings screen was to uninstall then reinstall again. This is less than ideal.

One other thing to beware of: don't try installing both these apps at the same time. We did it in an attempt to save time while taking screenshots for this article, and were left with a Start menu that constantly popped up and down of its own accord, each time taking focus away from what we were trying to do. Only restarting the PC then uninstalling the apps could fix it.

This aside, if you want to change the Start menu on your Windows 11 PC, there are two really good options out there. Some may also point to Explorer Patcher, which is free and makes Windows 11 more like Windows 10, but of the two options we've highlighted here, Start 11 takes the crown for reliability, while StartAllBack comes with more options. Make use of the free trials to test them both out, and see whether the changes they can make to your PC UI fit with the way you want to use it. **–IAN EVENDEN**

VERDICT 9 **Stardock Start 11**

STARTING UP Stable software; Nice-looking menus.

BACKING DOWN Fewer options than StartAllBack.

$5.99 (single license)

VERDICT 8 **StartAllBack**

STARTALLGOOD Lots of options and interface customizations.

STARTALLBAD Some unstable behavior.

$4.99 (single license)

© STARTALLBACK

LETTERS

WE TACKLE TOUGH READER QUESTIONS ON...

> Air vs water cooling
> Bored with games
> 12VHPWR confusion

Blowing hot air

In regards to the cover build in the August 2023 issue of *Maximum PC*—the pairing of an overclockable Intel Core i5 13600K CPU and Z790 motherboard in conjunction with an Intel stock CPU cooler just doesn't make sense. You're paying a $30-$50 premium per part for OC capability, yet you lack sufficient cooling for the task. Furthermore, one of the top features of the Corsair 2000D case is that it can fit a full-size GPU in conjunction with a 360mm AIO liquid cooler. While such a cooling solution is overkill for this particular CPU, it would have been nice to have highlighted this feature at the very least.

However, I love the editorial from your last issue bemoaning the current state of GPU pricing. Not only is Nvidia's 4060 Ti woefully overpriced in either VRAM configuration, but AMD is also so apprehensive, it decided to lower the MSRP of the Radeon RX 7600 by $40 mere hours ahead of launch, according to some outlets. We're in an interesting time right now in the hardware space, in which previous gen GPU models remain compelling options given the lack of good low and midrange options under $700.

– S. Porter

EDITOR-IN-CHIEF, GUY COCKER, RESPONDS: Thanks for your feedback on the build. Sam did say in the component section of the feature that the case would take up to a 360mm radiator, but as you say, he elected to use an Intel stock air cooler in this particular build. We usually tend to do that on budget builds where every component needs to offer high value, or builds where the CPU can't be overclocked or is of a lower performance. In the real world, I'd personally do like you suggested and add an AIO in there, but each to their own, and you can always add one at a later stage if you require.

As you say, our columnists haven't gone easy on the latest graphics card releases, particularly from Nvidia. While we've been quite positive about the RTX 4070 and the 4090, we've been less impressed with the 4060, which we say in our review on page 74 should have been called the 4050 based on its performance. As a completely independent publication, you can trust us to not pull our punches when it comes to our opinions on the latest tech.

Waning gaming

Having been a gamer since the days of the TRS-80, ATARI, and Commodore, I find my enthusiasm waning when game choices seem slim. Lately, the majority of games lack any appeal whatsoever. When they're not dark, dismal, dystopian, or depraved, they are simply cartoonish. I've also noticed a bit of dissatisfaction from other gamers, as well across various online and print publications as cited in articles of various sources. Many articles lament the cost and time it takes these days to publish a new AAA game, with the belief that every new game must be groundbreaking and something unique and never-before-seen. This all impacts hardware buying decisions, too. Upgrades are less likely without a decent reason for the costs. I believe that a new tact needs to be taken.

I think a game world or universe should be created to last many years. It could be done by creating the original portion of the game and then, once the major engine work and initial story have been done, releasing new chapters/episodes/levels on a periodic basis (and not just for multiplayer). A game might last many years like this, and even incorporate engine or graphics upgrades as required. Support for this concept can be proven by many gamers replaying older games simply because the new ones don't appeal. Add in the popularity of DLC for your favorite games, or remakes that cost full price because they are prettier graphically, and it is clear that once a gamer finds a game they like, they will stick with it, like going to a favorite restaurant.

I think developers need to think about things differently, and instead of trying to create something new every few years at great cost, they should perpetuate the

↘ submit your questions to: editor@maximumpc.com games already created into a "living" thing. New concepts could be introduced as tangential story arcs or side quests. No need to rebuild everything from the outset, just add to it. It also keeps developers onboard with something they know and are familiar with. That's my two cents, anyway!

–I. Hayes

EDITOR-IN-CHIEF, GUY COCKER, RESPONDS: I can certainly relate to what you're saying when it comes to the state of games. The only games I've played recently are *Dead Space* and *Resident Evil 4*, two remakes of games that I'd already completed over a decade ago. Yes, they've been updated with sparkly graphics and modern game mechanics, but I essentially chose them because they were safe, comforting, and ultimately nostalgia-based games.

Your idea of the persistent game world sounds a little like *Ready Player One*, as well as the upcoming game *Everywhere* from ex-Rockstar developers Build A Rocket Boy. While it's incredibly ambitious to build what you describe, I'm sure something similar will come along—look at the biggest games of the last decade, which have been evolving platforms like *Minecraft*, *Fortnite*, and *Roblox*. It will be interesting to see how games evolve in the coming years—the audience is bigger than ever, yet a lot of people my age (which is now sadly 40 and above) seem to feel a sense of malaise when faced with modern titles.

Shifting gears

I'm about to build a very high-end gaming rig with the RTX 4090 and the new Shift PSU with the awesome new side connectors.

The new Corsair Shift PSUs don't have a native 12VHPWR connector on the PSU (why would Corsair do that with a new ATX 3.0 PSU?), which means you have to use a "dreaded" adapter cable of some type. It is not straight GPU 12VHPWR to PSU 12VHPWR.

In the Turbo Build description, you said the side connectors made life 1000x better, which I knew. But then you said, "We got our hands on a new cable perfect for 4090 GPUs that bypasses the need for the dreaded GPU PCIe splitter."

Please clarify because I'm trying to figure out what to order and get the best possible cable solution for the new Shift PSU and the 4090's 12VHPWR connector. Does this cable come with the PSU? Is it a separate upgraded Corsair cable? Cablemod?

Corsair makes a custom cable kit (Corsair Premium Individually sleeved Type-5 PSU cable Pro Kit). Will it work with the Shift? Does Corsair provide a cable with the Shift PSU that is better for the 4090 and how is it not split adapted when it has to be? The PSU has no native 12+4 pin 12VHPWR connector (which is incredible—why would Corsair leave that off the new Shift PSUs?).

Would it help to buy the very popular Cablemod 12VHPWR 90 or 180 degree adapter? I'm building one of two huge cases—in the new Dark Pro 901 or maybe the Corsair 7000c RGB (If they update it for the new iCue link smart system that is coming out with the new fans, hub, and AIO cooler that can be all linked together with one proprietary cable, that would be awesome).

– G. Johnson

EDITOR-IN-CHIEF, GUY COCKER, RESPONDS: I went straight to the source on this one and spoke to the previous editor of *Maximum PC*, Zak Storey, who now works over at Corsair. He said:

Our RMx SHIFT PSUs, come with our small form factor Type-5 cables. These are slightly smaller than standard, to help with case configuration, and minimizing cable bulk. These are the same cables as found on the new SFX-L PSUs as well.

I can confirm that both our latest RMx SHIFT and the SFX-L PSUs come with a 12VHPWR600W direct cable included in the box as standard, that's compatible with both the PSU and the form-factor. We don't currently manufacture an adapter in any capacity. The 12VHPWR600 cable included with both PSUs (at all wattages) plugs directly into the PCIe slot on the PSUs themselves, there's no need for a new connection point on the PSU side.

We also have the RMe series of PSUs as well, these are brand new, ATX 3.0 compatible, and include a Type 4 12VHPWR600W as standard too at any wattage. So basically, any new CORSAIR PSU, at any wattage, that's labelled as ATX 3.0, will come with a 12VHPWR600 cable by default in the box.

If you don't have one of our latest ATX 3.0 compatible PSUs, but a slightly older model, and still would like a direct PSU to GPU cable, you can still buy those from the CORSAIR webstore as well. As these are still fully compatible with older units (as long as you have the spare wattage available, and are using a CORSAIR PSU with Type 4 cables supported).

Thanks Zak! Hope this helps clear things up.

Raiding the vaults

Thanks for replying to my recent letter (Melting Point, August 2023).

In your reply, you discuss RAID 5. I think there is an issue with RAID arrays containing large HDDs of which your readers should be made aware. This is the issue of unrecoverable read errors when rebuilding an array of large drives after a drive failure.

If you have a RAID 5 array with 4x10TB consumer HDDs (which typically have an unrecoverable read error rate of 10^-14), the probability of a successful, errorless, RAID rebuild is nine percent! If you use enterprise class drives (10^-15 read error rate), the probability of a successful rebuild rises to 79 percent. As the drives get larger, the problems get worse, and a 6 drive RAID 5 array is worse than a 4 drive array. An example is that a RAID 5 array with six 12TB consumer drives has a one percent chance of rebuild. With enterprise drives this rises to only six percent.

This issue is the reason I have a RAID 1 array, with 2x18TB enterprise drives and an 87 percent 'rebuild' (successful copy from the second drive to a new drive) probability. If I had used 10TB drives, that would rise to 92 percent, but I need the space.

I think the subject of RAID arrays, including this potentially disastrous scenario of a rebuild failing, would make a great article. **—J. Taylor**

EDITOR-IN-CHIEF, GUY COCKER, RESPONDS: Thank you for this follow-up! I'll admit that redundancy isn't my strongest suit when it comes to PC tech, and I'd previously put my faith in Synology's SHR system (similar to RAID 5) to keep my data secure. I've never had to do a total rebuild, which is why I wasn't aware. I'm sure many other readers won't be either, so thanks for the update!

THE BUILDS

THIS MONTH'S STREET PRICES...

BUDGET

EACH MONTH we try to reduce the overall price points of our builds. Thankfully, time is on our side, and plays an important role here. As the year continues, more sales are popping up while the current-gen gear increases with age. The cycle will inevitably repeat itself, but for now, we find ourselves being able to pick up the latest generation of components at reasonable prices. Retracting from our statement slightly already, we are keeping DDR4 RAM in the budget systems. This is due to our motherboard choices: these are powerful enough for these budget PCs, but bring our costs down significantly compared to using DDR5 RAM and compatible mobos.

Speaking of our RAM, we brought the PNY XLR8 Gaming EPIC-X RGB 16 GB DDR4-3600 in a few issues ago, and it remains in both the Intel and AMD machines. Again, it has more than enough juice to perform multiple tasks and keep the machine snappy, plus it's $5 cheaper than last time!

Another key component of our Intel build, which we also brought into our main feature in this issue, was the Intel Core i3-13100F. It's an admirable brain for the build, and remains here too, $10 cheaper than before. An additional price decrease can be found when we look at our GPU, the Intel Limited Edition Arc A750 8GB. Previously $250, it's now on sale at $220. Nothing else changes on our Intel budget build; these sales bring our overall price from $828 to $766.

Over on AMD, things aren't as fortunate. Our GPU was no longer on sale, and has gone back up to $290 from $230. It's the cheapest 6600XT we can pick up, and is still a great budget-end graphics card. As for the CPU, we've stuck with the AMD Ryzen 5 5600. This also saw a price increase, not as large as the GPU but still an additional $8! Nothing changes on the AMD budget build, but the price has now been bumped up from $825 to $888.

AMD INGREDIENTS

PART		PRICE
Case	Corsair 4000D Airflow	$95
PSU	450W Corsair CV450 80+ Bronze	$59
Mobo	MSI B550M PRO-VDH WIFI Micro ATX AM4 Motherboard	$119
CPU	AMD Ryzen 5 5600	$138
GPU	ASRock Phantom Gaming D OC Radeon RX 6600 XT 8GB	$290
RAM	16GB (2 x 8GB) PNY XLR8 Gaming EPIC-X RGB DDR4 @ 3600MHz	$45
SSD	500GB Corsair MP600 PRO NH PCIe 4.0 M.2 SSD	$60
HDD	2TB Seagate Barracuda Compute 7200	$50
OS	Windows 10 Home 64-bit OEM (Windows 11 Compatible)	$32
Approximate Price:		**$888**

INTEL INGREDIENTS

PART		PRICE
Case	Corsair 4000D Airflow	$95
PSU	450W Corsair CV450 80+ Bronze	$59
Mobo	ASRock B660M Pro RS Micro ATX GA1700	$95
CPU	Intel Core i3-13100F	$110
GPU	Intel Limited Edition Arc A750 8GB	$220
RAM	16GB (2 x 8GB) PNY XLR8 Gaming EPIC-X RGB DDR4 @ 3600MHz	$45
SSD	500GB Corsair MP600 PRO NH PCIe 4.0 M.2 SSD	$60
HDD	2TB Seagate Barracuda Compute 7200	$50
OS	Windows 10 Home 64-bit OEM (Windows 11 Compatible)	$32
Approximate Price:		**$766**

MID-RANGE

FOR OUR MID-RANGE MACHINES, our budget (or shall we say, virtual budget) increases to allow us to enter QHD gaming, with enough punch for a powerful system. In fact, for most cases, these builds offer more than enough oomph to get through the majority of tasks, games, and creative work.

On team Intel, we have one of our favorite chips, the Core i5-12600K. It is still a fantastic productivity and gaming CPU, comes in at a great price, and can be overclocked well enough to exhaust more power than it already holds. Although it's not as impressive as its successor, we'll keep it here, as it's also $115 cheaper.

As for the AMD mid-range build, that maintains the Ryzen 5 7600X. It's a very comparable chip to the i5-12600K, both in performance and price. We see sales on both of these chips too—Intel sits at $197, and AMD is one cent below $200. Both are fantastic brains for your builds, so these stay firmly in place.

What changes have we made to the GPUs on both systems? On AMD, out goes the Gigabyte Radeon RX 6750 XT GAMING OC 12GB, and in comes the ASRock Challenger Pro OC Radeon RX 6750 XT 12 GB. This is purely to save some money, as the latter can be picked up for $360—$20 less than the previous Gigabyte GPU. As for Intel, we also replaced a Gigabyte GPU, the Gigabyte GeForce RTX 4060 Ti EAGLE 8GB, for an alternative. We chose the MSI VENTUS 2X BLACK OC GeForce RTX 4060 Ti 8GB as this saves us $10. Not a large saving, but a saving nonetheless.

We kept the same motherboards to house all our components. This includes the newly added ASRock B650M PG RIPTIDE Wi-Fi Micro ATX to the AMD build—with no price changes, we didn't see it fit to replace either. The same applies to the SSD/RAM combos for both machines. Overall, the AMD machine saw a saving of $80. The Intel build didn't get quite the same price cut—only $33—but its final price tag is a sweeter $1,332.

AMD INGREDIENTS

PART		PRICE
Case	NZXT H7 Flow	$130
PSU	750W EVGA 750 BP 80+ Bronze	$90
Mobo	ASRock B650M PG RIPTIDE Wi-Fi Micro ATX AM5	$200
CPU	AMD Ryzen 5 7600X	$240
Cooler	MSI MAG CORELIQUID 240R V2	$95
GPU	ASRock Challenger Pro OC Radeon RX 6750 XT 12GB **NEW**	$360
RAM	32GB (2x 16GB) Corsair Vengeance DDR5 CL40 @ 4800MHz	$98
SSD	1TB PNY CS3140 NVME M.2 PCIe 4.0 SSD	$75
HDD	2TB Seagate Barracuda Compute 7200	$50
OS	Windows 10 Home 64-bit OEM (Windows 11 Compatible)	$32
Approximate Price:		**$1,370**

INTEL INGREDIENTS

PART		PRICE
Case	NZXT H7 Flow	$130
PSU	750W EVGA 750 BP 80+ Bronze	$90
Mobo	Gigabyte Z790 UD AC ATX LGA 1700	$180
CPU	Intel Core i5-12600K	$197
Cooler	MSI MAG CORELIQUID 240R V2	$95
GPU	MSI VENTUS 2X BLACK OC GeForce RTX 4060 Ti 8GB **NEW**	$390
RAM	32GB (2x 16GB) Corsair Vengeance DDR5 CL40 @ 4800MHz	$98
SSD	1TB Corsair MP600 PRO NH M.2 PCIe 4.0	$70
HDD	2TB Seagate Barracuda Compute 7200	$50
OS	Windows 10 Home 64-bit OEM (Windows 11 Compatible)	$32
Approximate Price:		**$1,332**

TURBO

IT'S TIME TO OPEN UP the throttle on a wide and empty road and let our machines roar to full capacity in the turbo section. Here, we can allow our imaginations to take flight and create two fantastic PCs both for team Intel and team AMD. Sure, a high price tag is inevitable here, but we do try to keep a beady eye on where we can save some money if possible. The main costs in these builds are typically the GPUs, with the CPUs following behind.

Kicking things off, we made a GPU change on the Intel machine, replacing the ZOTAC GeForce RTX 4090 GAMING AMP Extreme AIRO 24GB with the Zotac GAMING Trinity OC GeForce RTX 4090 24GB. The former costs $1,629, so to save some money and not sacrifice performance, we brought in the GAMING Trinity OC variant at $1,600.

We were going to apply the same method of thinking on the AMD machine by replacing that GPU for a cheaper variant of the same card, but the ASRock Phantom Gaming OC is still the cheapest Radeon RX 7900XTX card available, and compared to our last issue, it now has a saving of $40. For under $1,000, it's the best AMD offers at the moment, and will certainly provide you with a high-end 4K gaming experience. To keep the system and the monstrous AMD Ryzen 9 7950X3D cool, we've swapped out the Elite version of the NZXT Kraken X73 for a cheaper variant, as it offers the same cooling capabilities, while also having a more impressive display, but saving us around $75. We also took that cooler and brought it over to the Intel machine to keep the i9-13900K cool.

Another component that we've shared across the board was the WD Black SN850X. We've upgraded the capacity of this to 2TB, as this is currently under $10— a brilliant choice for a primary SSD at this price range. Our overall prices of the AMD and Intel Turbo builds both decreased. The final price tag for the AMD comes in at $2,841 from $2,954. For the Intel behemoth, the final price is now $3,201 from $3,420. It brings both machines closer in price—it's just the huge difference between the RTX 4090 and the Radeon RX 7900XTX that keeps the divide there.

AMD INGREDIENTS

PART			PRICE
Case	Phanteks Enthoo Pro 2 Tempered Glass		$190
PSU	1000W NZXT C1000 80+ Gold		$180
Mobo	ASRock X670E PG Lightning ATX AM5		$260
CPU	AMD Ryzen 9 7950X3D		$650
Cooler	NZXT Kraken X73 RGB 360mm	NEW	$225
GPU	ASRock Phantom Gaming OC Radeon RX 7900 XTX 24GB		$940
RAM	64GB (2x 32GB) Corsair Vengeance DDR5 CL40 @ 5200MHz		$165
SSD	2TB WD Black SN850X M.2 PCIe 4.0	NEW	$99
HDD	6TB WD Blue 5400 HDD		$100
OS	Windows 10 Home 64-bit OEM (Windows 11 Compatible)		$32
Approximate Price:			**$2,841**

INTEL INGREDIENTS

PART			PRICE
Case	Phanteks Enthoo Pro 2 Tempered Glass		$190
PSU	1000W Corsair RM1000x Shift 80+ Gold		$210
Mobo	Gigabyte Z790 UD AC ATX LGA 1700		$180
CPU	Intel Core i9-13900K		$409
Cooler	NZXT Kraken X73 RGB 360mm	NEW	$225
GPU	Zotac GeForce RTX 4090 GAMING Trinity OC 24GB	NEW	$1,591
RAM	64GB (2x 32GB) Corsair Vengeance DDR5 CL40 @ 5200MHz		$165
SSD	2TB WD Black SN850X M.2 PCIe 4.0	NEW	$99
HDD	6TB WD Blue 5400 HDD		$100
OS	Windows 10 Home 64-bit OEM (Windows 11 Compatible)		$32
Approximate Price:			**$3,201**

Maximum PC (ISSN 1522-4279) is published 13 times a year, monthly plus a Holiday issue following the December issue, by Future US LLC, 130 West 42nd Street, 7th Floor, New York, NY 10036. USA. Website: www.futureus.com. Future US LLC also publishes *Mac|Life*, and *PC Gamer*. Entire contents copyright 2023, Future US LLC. All rights reserved. Reproduction in whole or in part is prohibited. Future US LLC. is not affiliated with the companies or products covered in *Maximum PC*. Reproduction on the Internet of the articles and pictures in this magazine is illegal without the prior written consent of *Maximum PC*. Products named in the pages of *Maximum PC* are trademarks of their respective companies.

PRODUCED IN THE UNITED STATES OF AMERICA.

The Electronic Frontier Foundation is the leading nonprofit organization defending civil liberties in the digital world. Founded in 1990, EFF champions user privacy, free expression, and innovation through impact litigation, policy analysis, grassroots activism, and technology development. We work to ensure that rights and freedoms are enhanced and protected as our use of technology grows.

EFF.ORG

ELECTRONIC FRONTIER FOUNDATION

Protecting Rights and Promoting Freedom on the Electronic Frontier

PC GAMER
EDITOR'S CHOICE
MAXIMUM PC
KICK ASS!

We build the world's most advanced PCs.

Experience a new level of performance with an award-winning Digital Storm PC. Built with the latest technology, highest quality components and backed by lifetime support. Visit our website and build your dream PC today.

DIGITALSTORM

LEARN MORE: WWW.DIGITALSTORM.COM
Digital Storm PCs featuring Intel® Core™ i7 processors.

The Digital Storm Logo, and 'World's Most Advanced PCs' are trademarks of Digital Storm.Intel, the Intel Logo, Intel Inside, Intel Core, and Core Inside are trademarks of Intel Corporation in the U.S. and/or other countries.